2016 West Coast of Vancouver Island Salmon Extensive Escapement Stream Summary

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Canadian Data Report of Fisheries and Aquatic Sciences

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ABSTRACT

In 2016, spawner surveys were conducted on 47 streams on the west coast of Vancouver Island, DFO statistical areas 20 to 27. The individual survey counts by species are presented in this data report as well as the expansion factors used to make annual estimates of escapement. The escapement estimates are accompanied by data quality levels and commentary on the general observations of the return with respect to previous years, unusual conditions and survey timing. The stream protocols are briefly described with emphasis on any deviations from the standard snorkel survey assessment method. General observations on environmental conditions and any changes in the physical characteristics of the stream or surrounding area are also reported. Enhancement activities and biosamples are described. These observations and results have been discussed and agreed upon by surveyors and DFO stock assessment biologists. The in-season and post-season bulletins are shown in the final section.

RÉSUMÉ

En 2016, des relevés des reproducteurs ont été effectués dans 47 cours d'eau de la côte ouest de l'île de Vancouver, dans les secteurs statistiques 20 et 27 de Pêches et Océans Canada (MPO). Les décomptes individuels par espèce sont présentés dans le présent rapport de données, de même que les facteurs d'expansion utilisés pour estimer le nombre d'échappées annuel. Les estimations des échappées sont accompagnées de niveaux de qualité des données et de commentaires sur les observations générales relatives à la montaison par rapport aux années passées, aux conditions inhabituelles et au moment du relevé. Les protocoles des cours d'eau sont brièvement décrits, et l'accent est mis sur les dérogations à la méthode standard d'évaluation des relevés en plongée avec tuba. Les observations générales sur les conditions environnementales et tout changement aux caractéristiques physiques du cours d'eau ou de la zone environnante sont également consignés. De plus, les activités de mise en valeur et des échantillons biologiques sont décrits. Ces observations et résultats ont été examinés et approuvés par les inspecteurs et les biologistes chargés de l'évaluation des stocks du MPO. Les bulletins en cours de saison et d'après-saison sont présentés dans la section finale.

STREAMS IN AREA 20

1. AREA 20 SUMMARY OF OBSERVATIONS IN 2016

1.1. Overview

Almost 28 streams and major tributaries in Area 20 have records of spawning salmon in the DFO escapement database (1952 – 2015). Most systems are surveyed using the snorkel method described in the DFO snorkel survey manual, and occasionally by stream or bank walks. The San Juan watershed is too large to be surveyed using our standard snorkel method, but a counting fence installed from early-September to mid-October generally allows for a good estimate of Chinook. The Coho estimates come from a combination of the fence data and a few peak counts from the tributaries. Surveys are typically conducted by DFO contractors, First Nations and local enhancement groups. The San Juan River Chinook and Coho populations have also been enhanced by the Port Renfrew Salmon Enhancement Society since the 1980s. Chinook populations in Harris Creek and the Sooke River have also been regularly enhanced since the 1980s. Figure 1-1 shows the Area 20 systems surveyed in 2016.

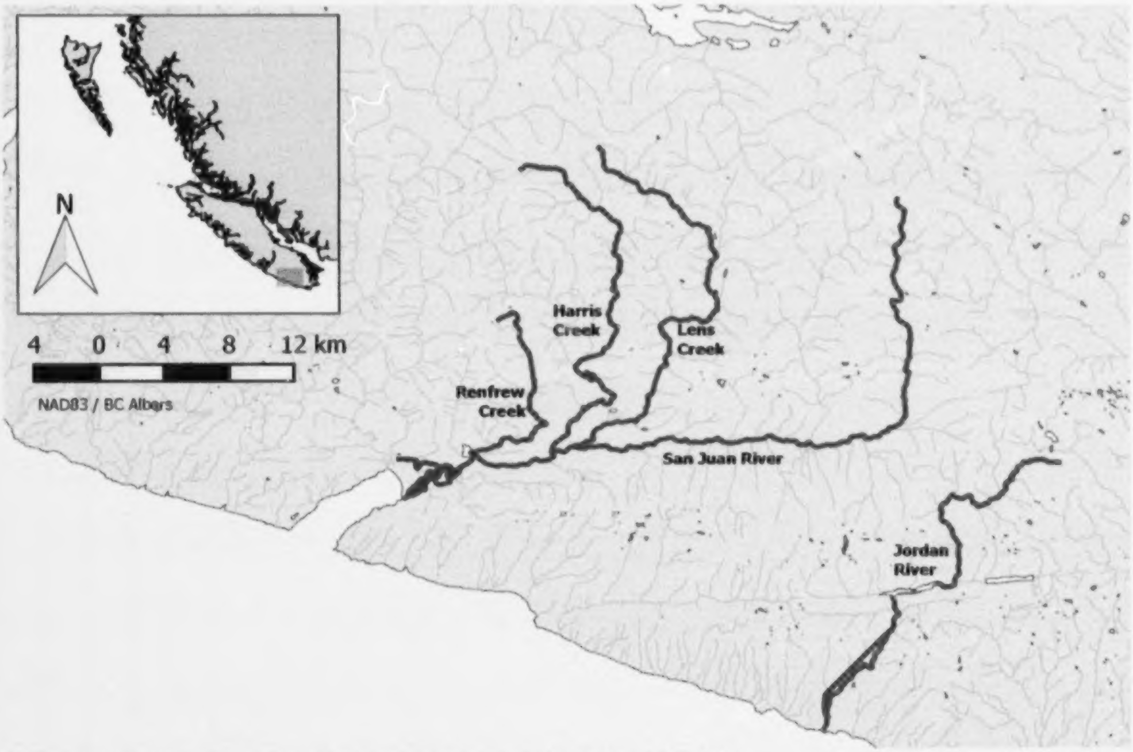


Figure 1-1. Streams in Area 20 that were surveyed in 2016 (highlighted blue).

1.2. 2016 Operational Summary

In 2016, the fence operated from Sept 11 to Oct 3, which is similar to previous years. The surveys of San Juan and major tributaries were delayed by high water events in October and November. Seven snorkel surveys were conducted on the San Juan River after the fence came down, and one on each of Harris Creek, Lens Creek and Renfrew Creek. Funding allowed for the Jordan River to also be surveyed once.

The San Juan Chinook estimate came from the fence. San Juan and three major tributaries were surveyed in October to provide a Coho peak count. Based on the data available (fence counts, reports from hatchery staff, and available surveys), Chinook and Chum returns were near average but Coho were below average.

Table 1-1. The raw (i.e. unexpanded for observer efficiency) Peak Live+Dead counts of adult salmon by DFO Statistical Week (e.g. 9-4 is the fourth week in September) for each species. Underlined counts represent 1-9% spawning, italicized counts represent 10-49% spawning, ***bold*** *counts represents >50% spawning. Counts coloured pink are from the fence, and counts coloured blue are from snorkel surveys.*

Colour codes for escapement method and plan	
Bank Walk	Helicopter
Stream Walk	Fence
Snorkel	Missed
Boat	Revised plan

System	Species	9-3 Sept 11-17	9-4 Sept 18-24	10-1 Sept 25-Oct 1	10-2 Oct 2-8	10-3 Oct 9-15	10-4 Oct 16-22	10-5 Oct 23-29	11-1 Oct 30-Nov 5	11-2 Nov 6-12	11-3 Nov 13-19	11-4 Nov 20-26	11-5 Nov 27-Dec 3	12-1 Dec 4-10	12-2 Dec 11-17
SAN JUAN RIVER	Sockeye	0	2	4				0		0	0	0	0	0	0
HARRIS CREEK	Sockeye										0				
JORDAN RIVER	Sockeye												0		
LENS CREEK	Sockeye								2						
RENFREW CREEK	Sockeye										1				

System	Species	9-3 Sept 11-17	9-4 Sept 18-24	10-1 Sept 25-Oct 1	10-2 Oct 2-8	10-3 Oct 9-15	10-4 Oct 16-22	10-5 Oct 23-29	11-1 Oct 30-Nov 5	11-2 Nov 6-12	11-3 Nov 13-19	11-4 Nov 20-26	11-5 Nov 27-Dec 3	12-1 Dec 4-10	12-2 Dec 11-17
SAN JUAN RIVER	Coho	0	442	**694**				332		**95**	4				
HARRIS CREEK	Coho										65				
JORDAN RIVER	Coho												0		
LENS CREEK	Coho								*619*						
RENFREW CREEK	Coho										258				

System	Species	9-3 Sept 11-17	9-4 Sept 18-24	10-1 Sept 25-Oct 1	10-2 Oct 2-8	10-3 Oct 9-15	10-4 Oct 16-22	10-5 Oct 23-29	11-1 Oct 30-Nov 5	11-2 Nov 6-12	11-3 Nov 13-19	11-4 Nov 20-26	11-5 Nov 27-Dec 3	12-1 Dec 4-10	12-2 Dec 11-17
SAN JUAN RIVER	Chum	0	2	2				**534**		**97**	5				
HARRIS CREEK	Chum										4				
JORDAN RIVER	Chum												2		
LENS CREEK	Chum								7						
RENFREW CREEK	Chum										26				

System	Species	9-3 Sept 11-17	9-4 Sept 18-24	10-1 Sept 25-Oct 1	10-2 Oct 2-8	10-3 Oct 9-15	10-4 Oct 16-22	10-5 Oct 23-29	11-1 Oct 30-Nov 5	11-2 Nov 6-12	11-3 Nov 13-19	11-4 Nov 20-26	11-5 Nov 27-Dec 3	12-1 Dec 4-10	12-2 Dec 11-17
SAN JUAN RIVER	Chinook	0	641	577				12		0	0				
HARRIS CREEK	Chinook										4				
JORDAN RIVER	Chinook												0		
LENS CREEK	Chinook								3						
RENFREW CREEK	Chinook										0				

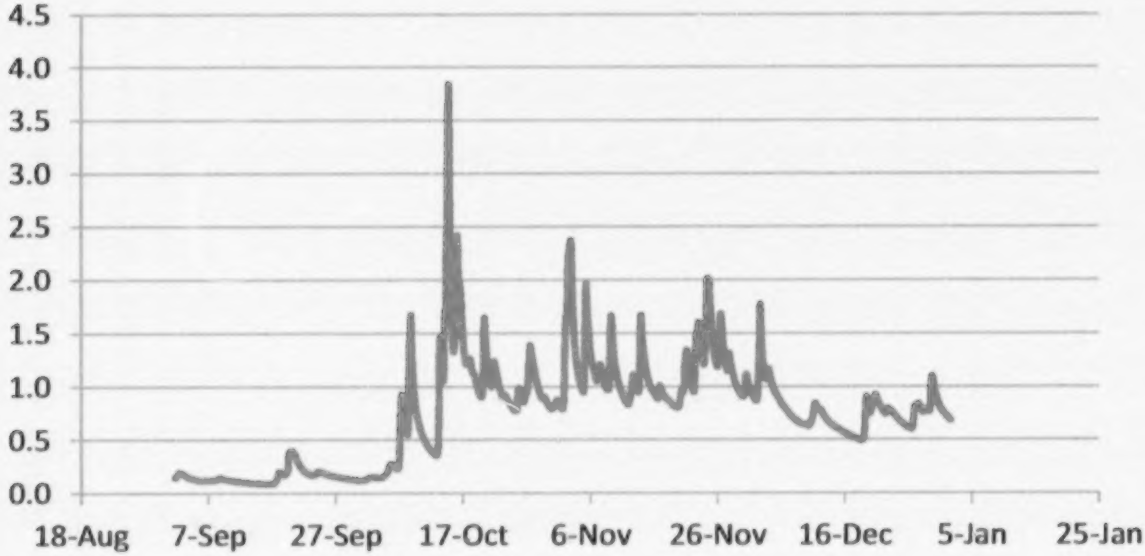


Figure 1-2. San Juan hydromet sensor depth in metres from Sept 2016 to January 2017.

2. SAN JUAN RIVER

2.1. Stream Summary

The San Juan River flows south then west into Port San Juan near the town of Port Renfrew (Figure 2-1). The mainstem is over 50 km long and is fed by many tributaries from the surrounding mountains. Its largest tributaries are Renfrew Creek, Harris Creek, and Lens Creek. The San Juan counts are made at a fence temporarily installed at survey marker 1 from early-September to mid-October. Periodic snorkel surveys are also conducted on the mainstem and tributaries through the spawning season.

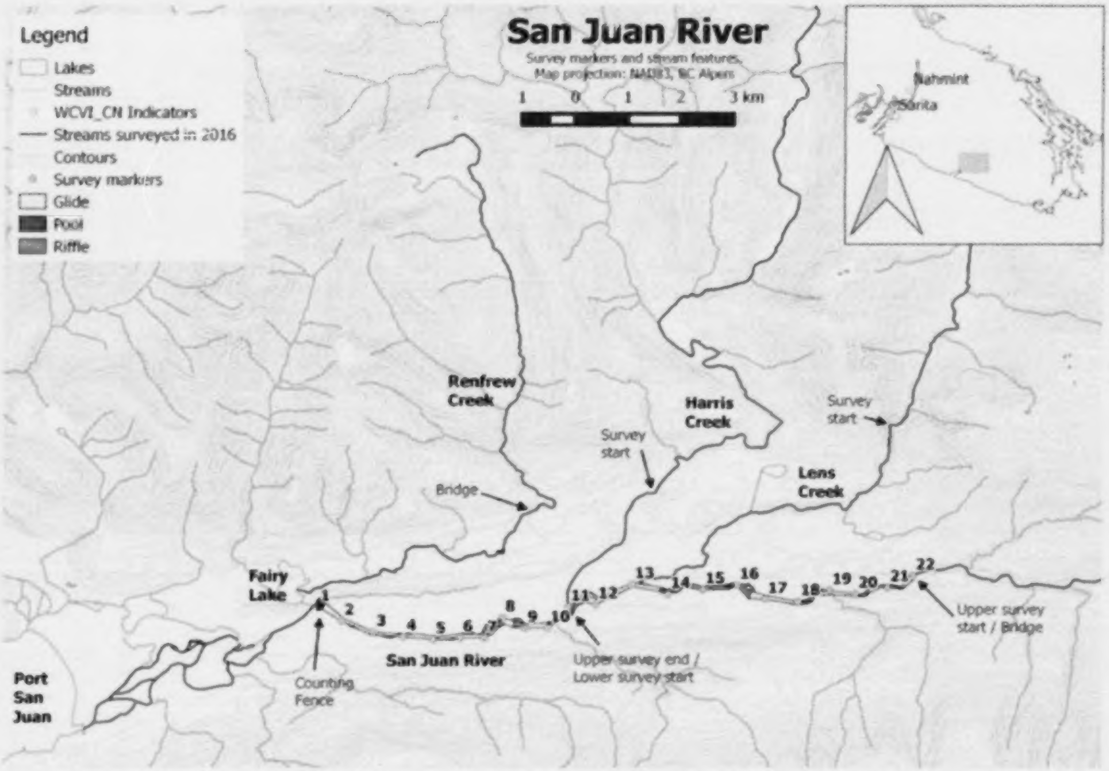

Legend
Lakes
Streams
WCVI_CN Indicators
Streams surveyed in 2016
Contours
Survey markers
Glide
Pool
Riffle
San Juan River
Survey markers and stream features.
Map projection: NAD83, BC Albers
1 0 1 2 3 km
Nahmint
Sarita
Renfrew Creek
Harris Creek
Lens Creek
Survey start
Survey start
Bridge
Fairy Lake
Port San Juan
Counting Fence
San Juan River
Upper survey end / Lower survey start
Upper survey start / Bridge
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22

Figure 2-1. The San Juan River habitat units and survey markers. Map inset show locations of other systems that are regularly surveyed in the region. Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. Habitat data were mapped in the field and / or digitized from recent high resolution orthophotographs by M.C. Wright and Associates Ltd.

The San Juan mainstem is generally surveyed in two parts over two days. The Upper San Juan survey covers from the bridge at survey marker 22 down to the pool just below the Harris confluence (survey marker 11). The Lower San Juan Survey covers from Harris confluence (survey marker 11) down to Fairy Lake confluence (fence site; marker 1).

The Renfrew Creek mainstem is almost 16 km in length. The creek enters the San Juan River through Fairy Lake, just below the counting fence. Renfrew Creek survey covers from above the bridge to the pull out above Fairy Lake (~9 km).

Harris Creek enters the San Juan River about 11 km upstream from the estuary at survey marker 11. The mainstem is about 32 km in length is fed mainly by many small tributaries from the surrounding mountains. Harris Creek survey covers from the side channel pool to the San Juan confluence (3.1 km).

Lens Creek enters the San Juan River about 13 km upstream from the estuary at survey marker 13. The mainstem is about 34 km in length and is also fed mainly by many small tributaries from the surrounding mountains. Lens Creek survey covers from Lens Canyon to San Juan confluence (7 km).

The San Juan River Chinook and Coho populations have also been enhanced by the Port Renfrew Salmon Enhancement Society since the 1980s.

2.2. Survey Results and Escapement Estimate

Survey Crew: Pacheedaht First Nation (surveys)/San Juan Enhancement Society (fence)
Stock Assessment Biologist: Diana McHugh

Fence Data

Table 2-1. San Juan Fence counts from Sep.18-30, 2016.

	Chinook			Coho	Chum	Pink	Steelhead	Sockeye
	F	M	3yr					
18-Sep	4	56	10	40				
19-Sep	7	70	18	47			1	
20-Sep	19	140	13	185	1		1	
21-Sep	8	40	7	54				
22-Sep	17	39	6	14	1	1	1	
23-Sep	15	49	11	20				1
24-Sep	33	69	10	82			2	1
25-Sep	57	140	21	338				2
26-Sep	48	133	13	138			1	1
27-Sep	13	30	6	79			1	1
28-Sep	6	32	9	78				
29-Sep	13	39	5	44	2			
30-Sep	2	11		17				
		1219		1136	4	1	7	6

Survey Data:

Table 2-2. Unexpanded live and dead counts by species for each survey, peak live plus dead (PL+D) raw and expanded for OE. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:
For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%; For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

				SK		CO		PK		CM		CN	
Date	**Location**	**OE cat.**	**Comments**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**
24-Oct	Upper San Juan River	Good	Water clear (3.5m), water normal (0.84m)			329	1			256		8	
25-Oct	Lower San Juan River	Good	Water tea (3m), water level normal (0.77m)			2				274	4		4
31-Oct	Lens Creek	Excellent	Water clear (4m), water level normal	2		618	1			7		3	
12-Nov	Upper San Juan River	Good	Water clear (3-5m), water level above normal (0.88m)			92	3			94	3		
18-Nov	Lower San Juan River	Excellent	Water clear (3.5m), water level normal (0.87m)				4				5		
18-Nov	Harris Creek	Excellent	Water clear (4-5m), water level normal			121	2			4			4
19-Nov	Renfrew Creek	Excellent	Water clear (4-5m), water level below normal	1		256	2			13	13		
			Raw PL+D										
			Exp PL+D										

Table 2-3. Survey life (SL), adult escapement estimate and rational how the method was applied. Escapement estimates use the OE described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Sp.	**Annual escapement estimate**	**Analytical method**	**Data quality level**
SK	6	Partial Fence	2
CO	1,136	Partial Fence	3
PK	1	PL+D	2
CM	593	PL+D	2
CN	899 esc+320 brood= 1,219 total	Fence	2

Escapement Commentary:

SK return:	Fairly Average, few sockeye are typically seen in San Juan during the fence operation or swim surveys.
CO return:	Low based on the counts and spawning extent observed by the survey crew.
PK return:	
CM return:	Fairly average relative to recent years.
CN return:	Fairly Average, hatchery crew reported an increase relative to recent years.

2.3. Spawner Distribution

Run Timing:

Table 2-4. The run timing for the survey year by species.

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye				Mid Sept		Early Nov	
Coho				Mid Sept	Late Oct	Early Nov	Late Nov
Pink				Mid Sept	Mid Sept		
Chum				Mid Sept	Late Oct	Late Oct	Early Nov
Chinook				Mid Sept	Mid Sept	Early Oct	Late Oct

Spatial distribution

Oct 24:	A few CO holding in the run below the Upper San Juan Bridge, then no fish at the Red Creek confluence (which is usually a CO spawning area); 171 CM spawning between Bars 6 and 7(near Marker 15), a few (< 20) spawning just above Lens confluence (Section 14-15)
Oct 25:	183 CM spawning below Harris Confluence (~Section 8-9), and 45 spawning near Marker 7
Nov 12:	A few coho (5) spawning at the Upper San Juan Bridge (Marker 22), 35 CO spawning at the Red Creek confluence (Section 19-20); 88 CM spawning on Bar 7 (Section 17-18)
Nov 18:	Harris confluence to Fairy Lake, no live fish observed.

2.4. Environmental Conditions

Weather Summary:	Water levels in October and November were generally high and visibility was reduced compared to recent years.
Physical Characteristics Update:	None reported.

2.5. Update to Stream Survey Protocols

Current Assessment Method:	Fence installed from early September to mid-October (Thanksgiving) to collect brood and count all species through the fence. Snorkel surveys of San Juan and major tributaries following fence removal to generate a rough peak count.
Deviations from current assessment protocols:	Swims were delayed by high water events.
Access Updates:	No change.
Safety Update:	No change.

2.6. Enhancement

Plan:

Egg Target	Adults		Juveniles					
	Brood Target		Release Target	Release Stage	Release Site	# Marked / Tagged		
	Male	Female				Ad CWT	Ad Clip	Thermal
510,000	360	360	460,000 / 40,000	Subyearling Smolt / Seapen	San Juan River / Port Renfrew	40,000		500,000

Removals:

Chinook: 159 males, 159 females taken for brood; 570,000 eggs collected.

Coho: 718 adults and 70 jacks harvested by PFN beach seine fishery ~1km below the fence,

Commentary: Chinook at the fence were roughly ¼ female and ¾ male, survey conditions were generally good. Hatchery staff reported easy fishing compared to recent years. Pacheedaht Fishery Staff reported far fewer coho than expected during the Oct. and Nov. surveys.

Other Enhancement/Restoration Activities

Willow and cottonwoods were planted in San Juan for bed stabilization. Blocking access to some gravel bars with 2 m^3 boulders to allow the river to recover may occur depending on availability of appropriate rock and resources.

2.7. Biosamples

Fecundity estimate was an average of 3560 eggs per female.

2.8. Concerns and Comments

Continued use of the area by ATVs exacerbates erosion and in-filling. Large woody debris, which contributes to river stability, has also been lost due to individuals cutting it up for firewood. Educational signage and gates have been lost to vandalism. Large boulders (>2 m^3) have been recommended rather than gates to block access to sensitive areas, but larger equipment is needed to install them. Recreational use of firearms is a safety concern and has interfered with the completion of some surveys.

3. JORDAN RIVER

3.1. Stream Summary

The Jordon River is almost 30 km long and flows southwest into the Juan de Fuca Strait. The system was dammed in 1911 in order to supply power to local communities. The Elliott Reservoir is located about 8 km upstream from the mouth, the Diversion Dam is located about 10 km upstream from the mouth, and the Bear Creek Reservoir is located about 3 km upstream of the Diversion Dam on the Bear Creek Tributary.

The stream within 1 km of the mouth is accessible to anadromous salmon. The road to Port Renfrew (highway 14) crosses the river at the mouth and just upstream from the bridge is a dry land log sort. The lower end of the survey area is adjacent to the log sort. The survey extends about 850 km upstream from the log sort to the Rock-face Pool which is the top end of the survey area. The survey area includes several run and riffle sections and pools. The Tailrace Pool marks the location of a BC Hydro tailrace which joins the Jordan on river right about 300 m below the Rock-face Pool. There are several small tributaries that flow into the survey area, including two that flow from a mine portal and slag debris.

3.2. Escapement Estimates

Survey Crew: Pacheedaht First Nation (Helen Jones, Jeff Jones; comments by H. Jones)
Stock Assessment Biologist: Diana McHugh

3.3. Escapement Comments

The Jordan River was surveyed once in 2016 to continue monitoring the return of salmon following BC Hydro changes to the flow regime to improve habitat conditions for salmon. Two dead chum were observed Dec 1 during a period of clear water but above normal flows. In the Rock-face pool, there was spawning size gravel and some juvenile trout were present.

3.4. Environmental Conditions

3.5. Survey Protocols

Stream walk/snorkel of about 850 m from Rock-face Pool to the dryland sort riffle.

STREAMS IN AREAS 21, 22 AND 23

4. AREA 21-23 SUMMARY OF OBSERVATIONS IN 2016

4.1. Overview

Area 21 includes streams between Pachena Point and Bonilla Point on the west coast of Vancouver Island. Area 22, located inland of Area 21, includes streams draining into Nitinat Lake. Area 23 includes the streams draining into Barkley Sound. There are 4 streams and major tributaries in Area 21 with records of spawning salmon in the DFO database, 14 in Area 22, and over 60 in Area 23. Figure 4-1 shows the systems surveyed in 2016 in Areas 21, 22 and 23.

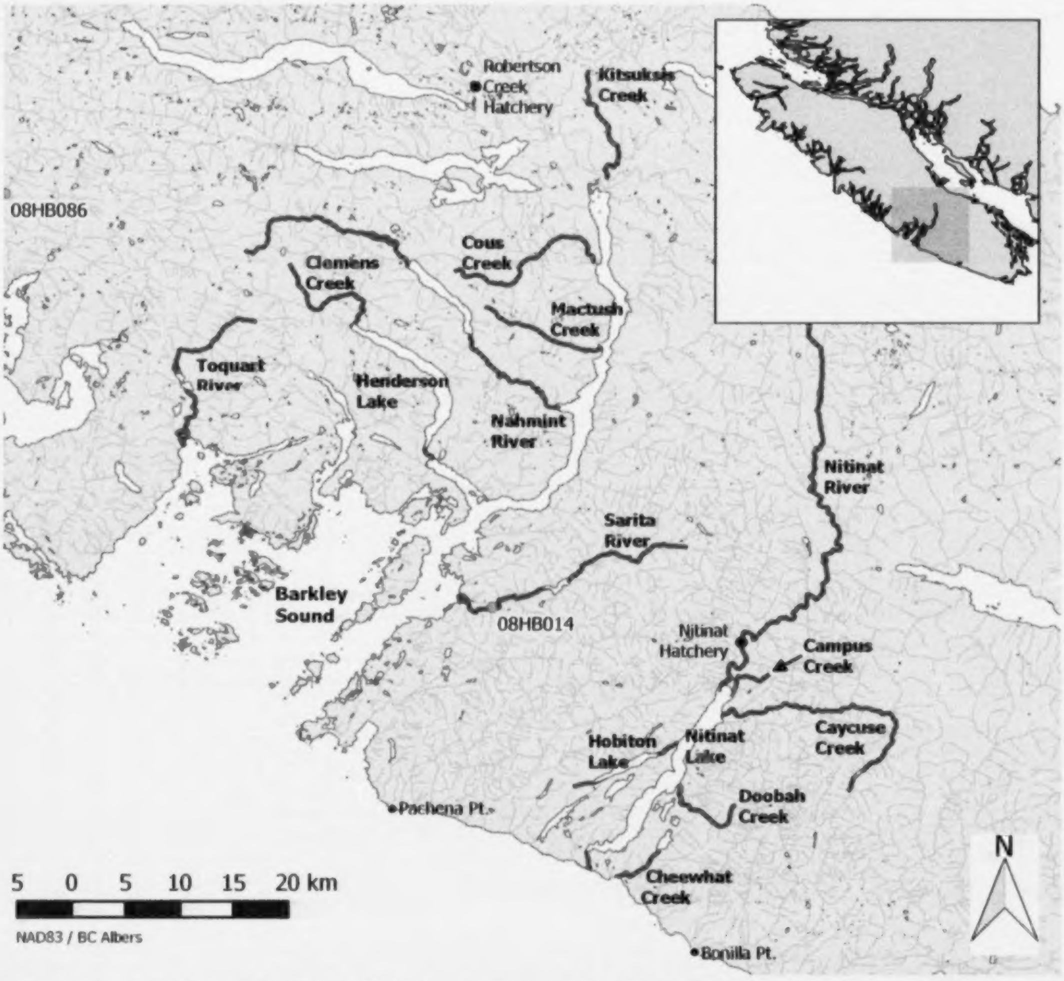

Robertson Creek Hatchery
Kitsuksis Creek
08HB086
Cous Creek
Clemens Creek
Mactush Creek
Toquart River
Henderson Lake
Nahmint River
Nitinat River
Sarita River
Barkley Sound
08HB014
Nitinat Hatchery
Campus Creek
Caycuse Creek
Hobiton Lake
Nitinat Lake
Doobah Creek
Pachena Pt.
Cheewhat Creek
Bonilla Pt.
5 0 5 10 15 20 km
NAD83 / BC Albers
N

Figure 4-1. Streams in Areas 21, 22 and 23 that were surveyed in 2016 (highlighted blue). The Environment Canada Hydromet station on the Sarita (08HB014) is a good indicator of flow in most systems in the area.

The Somass/Stamp River system is an intensive indicator stock and assessed through a coast-wide mark-recovery program and the data are not described in this report. Besides the Somass/Stamp, the priorities for escapement enumeration are the indicator stocks Sarita River, Nahmint River and Nitinat River. Additional systems are surveyed when funding allows and typically less frequently than the indicator systems. Most surveys are conducted using the snorkel method described in the DFO snorkel survey manual. Occasionally, systems are also surveyed by stream or bank walks. Surveys are typically conducted by DFO contractors, First Nations and local enhancement groups. The wild Coho indicator is Carnation Creek, which is enumerated at a fence operated by the Province of B.C.

The Sarita River and Nitinat River have been enhanced by the Nitinat River Hatchery since the 1980s. Robertson Creek Hatchery is a major enhancement facility on the Somass System and has been enhancing the Nahmint Chinook population when sufficient broodstock can be collected (since the 1980s). Thornton Creek and Toquaht River have been enhanced by the Thornton Creek Enhancement Society also since the 1980s.

4.2. 2016 Operational Summary

In Areas 21 and 22 in 2016, the Nitinat River mainstem was surveyed three times in addition visits to the Nitinat tributaries and Hobiton, Doobah, Caycuse, and Campus by Nitinat Hatchery and Ditidaht Fisheries staff. A fence was operated by Ditidaht and the Nuu-chah-nulth Tribal Council (NTC) to count Sockeye into Hobiton Lake from May 7 to July 16 when migrating fish had tailed off and were no longer showing in the river mouth below the fence. The NTC also visited the Cheewhat Creek.

Surveys occurred generally as scheduled early in the season, and water levels and temperature were conducive to migration throughout the escapement season, but some surveys were affected by high water levels in mid to late-October and early November. Based on the available surveys and observed extent of spawning, the return of chinook, coho, chum and sockeye in 2016 were good relative to recent years. Nahmint chinook are still well below the provisional optimal escapement (~1,200). The chum return was good, but based on the survey timing and historical peak date, the peak may have been missed so the magnitude of the return is uncertain. Pinks were largely absent this year.

Table 4-1. Escapement: Raw Peak Live + Dead Adult counts by statweek and Preliminary Escapement Estimates, font indicates the level of spawning observed. Underline: 1-9% spawning, Italics: 10-49% spawning, Bold: >50% spawning.

Colour codes for escapement method and plan	
Bank Walk	Helicopter
Stream Walk	Fence
Snorkel	Missed
Boat	Revised plan

Colour codes for esc. Est. compared to the 12 year avg.
> 125%
75%-125%
50%-75%
25%-50%
<25%

System	Species	9-1 Aug 28-Sep 3	9-2 Sept 4-10	9-3 Sept 11-17	9-4 Sept 18-24	10-1 Sept 25-Oct 1	10-2 Oct 2-8	10-3 Oct 9-15	10-4 Oct 16-22	10-5 Oct 23-29	11-1 Oct 30-Nov 5	11-2 Nov 6-12	11-3 Nov 13-19	Esc Est
NITINAT RIVER	Sockeye			387			300	18						450
CLEMENS CREEK	Sockeye	134	249	313	723	1636	*2525*	5565	3265	3188	2445		28	9,311
NAHMINT RIVER	Sockeye	75	521	622	378	*796*	*882*	940			11			1,486
SARITA RIVER	Sockeye		6	15	9	*67*		6			0			74
TOQUAHT RIVER	Sockeye			14		28								40
HOBITON CREEK	Sockeye													7,179
COUS CREEK	Sockeye					0								
MACKTUSH CREEK	Sockeye					0								

System	Species	9-1 Aug 28-Sep 3	9-2 Sept 4-10	9-3 Sept 11-17	9-4 Sept 18-24	10-1 Sept 25-Oct 1	10-2 Oct 2-8	10-3 Oct 9-15	10-4 Oct 16-22	10-5 Oct 23-29	11-1 Oct 30-Nov 5	11-2 Nov 6-12	11-3 Nov 13-19	Esc Est
CARNATION CREEK	Coho													197
NITINAT RIVER	Coho			10			*2026*	*395*						2,200
CLEMENS CREEK	Coho	0	97	174	697	899	934	1134	1183	1343	1011		137	2,000
NAHMINT RIVER	Coho	0	13	43	226	186	260	117			20			350
SARITA RIVER	Coho		15	49	373	500		459			3			831
TOQUAHT RIVER	Coho			266		116								300
COUS CREEK	Coho					0								
MACKTUSH CREEK	Coho					0								

System	Species	9-1 Aug 28-Sep 3	9-2 Sept 4-10	9-3 Sept 11-17	9-4 Sept 18-24	10-1 Sept 25-Oct 1	10-2 Oct 2-8	10-3 Oct 9-15	10-4 Oct 16-22	10-5 Oct 23-29	11-1 Oct 30-Nov 5	11-2 Nov 6-12	11-3 Nov 13-19	Esc Est
CARNATION CREEK	Chum													470
NITINAT RIVER	Chum			4			3444	48666						400,000
CLEMENS CREEK	Chum	0	0	0	4	28	45	150	*171*	90	71		6	200
NAHMINT RIVER	Chum	0	2	7	161	*593*	1580	*13280*			7037			22,892
SARITA RIVER	Chum		2	1	43	*344*		*5069*			26031			32,541
TOQUAHT RIVER	Chum			111		982								1,200
COUS CREEK	Chum					0								
MACKTUSH CREEK	Chum					0								

System	Species	9-1 Aug 28-Sep 3	9-2 Sept 4-10	9-3 Sept 11-17	9-4 Sept 18-24	10-1 Sept 25-Oct 1	10-2 Oct 2-8	10-3 Oct 9-15	10-4 Oct 16-22	10-5 Oct 23-29	11-1 Oct 30-Nov 5	11-2 Nov 6-12	11-3 Nov 13-19	Esc Est
NITINAT RIVER	Chinook			6002			3550	2157						10,000
CLEMENS CREEK	Chinook	0	0	0	13	24	16	34	11	1	1		0	40
NAHMINT RIVER	Chinook	55	145	173	243	*162*	242	*495*			2			678
SARITA RIVER	Chinook		1186	1045	1268	*1271*		1298			0			2,661
TOQUAHT RIVER	Chinook			150		153								200
COUS CREEK	Chinook					0								
MACKTUSH CREEK	Chinook					0								

- Nitinat - Chum spawning observed (great return(>150k) = a lot of CM spawning in Worthless Creek, this year all tributaries, including Worthless Creek, were plugged with CM, so the Hatchery estimates about 400k based on extended spawning throughout river indicating 200K at a time with turnover at least once; Hobbiton, Caycuse and Doobah also full of Chum).

- Clemens – Sockeye were much improved from last year; extensive spawning observed in the lake as well as in-stream.
- Nahmint – of ~600 Chinook, 73 brood removed, but only 31 spawned due to genetic ID of strays (13 females and 18 males ~55,000 eggs, which is 22% of the pre-season target.

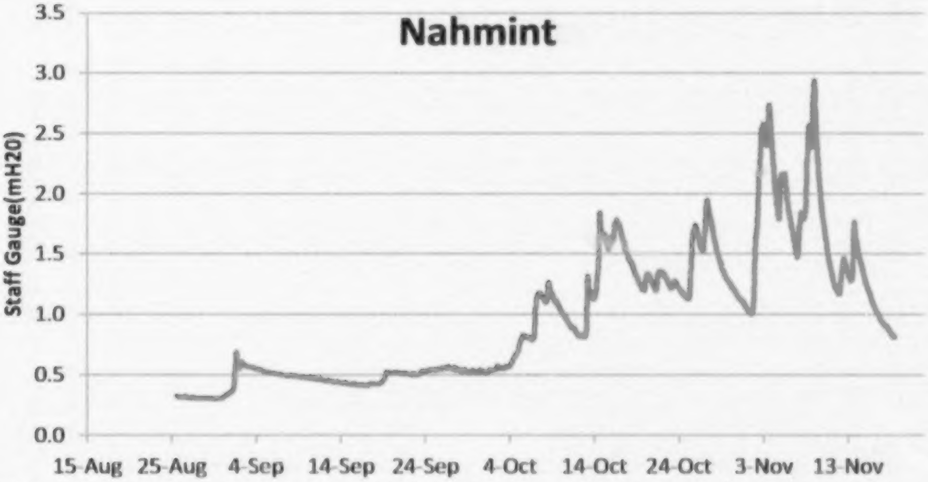


Figure 4-2. River conditions Aug 25 - Nov 18; water levels above 1.2 m compromise survey quality.

Table 4-2. Area 22 and 23 escapement survey plan matrix for 2016.

Planned Surveys/Activities

▨ AFS - Ditidaht
▨ AFS - Tseshaht
▨ AFS - Hupacasath
▨ Huu-ay-aht
▨ DFO Contract
▨ External non-DFO (NTC, Maa-nulth, etc.)
☐ External DFO/BC (SEP, MOF)

paler shade=cancelled
paler shade+cross hatch=rescheduled, but completed
survey completed data received

Stat Area	First Nation Territory	Stream Name	September				October					November					December		Comments		
			9-1	9-2	9-3	9-4	10-1	10-2	10-3	10-4	10-5	11-1	11-2	11-3	11-4	11-5	12-1	12-2	Survey Type and Target	# Planned	# Done
22	Ditidaht	CAMPUS CREEK																			
22	Ditidaht	CAYCUSE RIVER																			
22	Ditidaht	DOOBAH CREEK																			
22	Ditidaht	HOBITON CREEK																	Hobiton fence-Ditidaht May6-July9		
22	Ditidaht	JASPER CREEK																			
22	Ditidaht	LITTLE NITINAT RIVER																			
22	Ditidaht	NITINAT RIVER			cmld		cmld	cmld		cmld									PL+D: Chinook, coho, chum biodiversity	4	3
22	Ditidaht	NO-NAME CREEK																			
22	Ditidaht	PARKER CREEK																			
22	Ditidaht	WORTHLESS CREEK																			
23	Hupacasath	ASH RIVER																			
23	Hupacasath	BEAVER CREEK																			
23		CAMPSITE CREEK																			
23	Toquaht	CANOE PASS CREEK																			
23	Huu-ay-aht	CARNATION CREEK	Fence in Operation Year Round																Fence: Coho		
23	Uchucklesaht	CASS CREEK																			
23	Toquaht	CATARACT CREEK																			
23		CHERRY CREEK																			
23	Tseshaht/ Hupacasath	CHINA CREEK																	Tseshaht up to 2 surveys	2	0
23	Uchucklesaht	CLEMENS CREEK	cmld	cmld	cmld	cmld	cmld	cmld	cmld	cmld	cmld		cmld						AUC: Sockeye	10	11
23	Uchucklesaht/Yuutu?it?ath/Tseshaht	COEUR D'ALENE CREEK																			
23	Huu-ay-aht /Uchucklesaht/Tseshaht	COLEMAN CREEK																			
23	Huu-ay-aht /Uchucklesaht/Tseshaht	CONSINKA CREEK																			
23	Tseshaht/ Hupacasath	COUS CREEK																	Hup. and Tse. up to 2 surveys each	4	1
23	Hupacasath	DEER CREEK																			
23	Toquaht	DRAW CREEK																			
23	Hupacasath	DRINKWATER CREEK																			
23	Toquaht	DUTCH HARBOUR CREEK EAST																			
23	Toquaht	DUTCH HARBOUR CREEK WEST																			
23	Yuutu?it?ath(Ucluelet)/ Tseshaht/ Hupacasath	EFFINGHAM RIVER																	PL+D: Chum	4	
23	Hupacasath	FORESTRY CAMP CREEK																			
23	Tseshaht/ Hupacasath	FRANKLIN RIVER																	Hup. and Tse. up to 2 surveys each	4	0
23	Huu-ay-aht	FREDERICK CREEK																			
23	Uchucklesaht	HENDERSON LAKE																	Accoustic Trawl Survey (Juv)	0	
23	Yuutu?it?ath	HILLIER CREEK																			
23	Yuutu?it?ath/Uchucklesaht	HOLFORD CREEK																			
23	Yuutu?it?ath/Toquaht	ITATSOO CREEK																			
23	Tseshaht/ Hupacasath	KITSUCKSUS CREEK																			
23	Toquaht	LITTLE MAGGIE RIVER																			
23	Toquaht	LITTLE TOQUART CREEK																			
23	Toquaht	LUCKY CREEK																			
23	Tseshaht/ Hupacasath	MACKTUSH CREEK																	Hup. and Tse. up to 2 surveys each	4	1
23	Toquaht	MAGGIE RIVER																	PL+D: Chinook, coho, chum biodiversity	2	0
23	Hupacasath	MCBRIDE CREEK																			
23	Yuutu?it?ath	MERCANTILE CREEK																			
23	Yuutu?it?ath(Ucluelet)/ Tseshaht/ Hupacasath	NAHMINT RIVER	cmld	cmld	cmld	cmld	cmld	cmld	cmld		cmld								AUC: Chinook, chum, coho	8	8
23	Tseshaht/ Hupacasath	OWATCHET CREEK																			
23	Huu-ay-aht	PACHENA RIVER																	none in 2014		
23	Toquaht	PIPESTEAM CREEK																			
23	Huu-ay-aht	POETT NOOK CREEK																	PL+D: Chum		

23	Huu-ay-aht /Uchucklesaht/Tseshaht	RITHERDON CREEK																	none in 2014		
23	Huu-ay-aht	SARITA RIVER		unkl	unkl	unkl	unkl	unkl	unkl	unkl	unkl								AUC: Chinook, chum, coho	8	7
23	Toquaht	SECHART CREEK																			
23	Yuutu?it?ath	SMITH CREEK																			
23	Maa-nulth Charter Patrol	SNUG BASIN CREEK																			
23	Hupacasath/Tseshaht	SOMASS RIVER																	Also McCoy	4	1
23	Tseshaht/ Hupacasath	SPROAT RIVER	Cameras at Fishway																"Other" Intensive		
23	Tseshaht/ Hupacasath	STAMP RIVER																	"Other" Intensive		
23	Huu-ay-aht	SUGSAW CREEK																	PL+D: Chum	3	0
23	Hupacasath	TAYLOR RIVER																			
23	Yuutu?it?ath (Ucluelet)	THORNTON CREEK																		0	
23	Toquaht	TOQUAHT RIVER		unkl		unkl	unkl		unkl										PL+D: Chinook/chum	4	2
23	Toquaht	TWIN RIVERS EAST CREEK																		0	
23	Toquaht	TWIN RIVERS WEST CREEK																			
23	Uchucklesaht	UCHUCK CREEK																	Chinook/chum biodiversity		
23	Uchucklesaht/Tseshaht	USELESS CREEK																			
23	Yuutu?it?ath(Ucluelet)/ Tseshaht	VERNON BAY CREEK																	Chinook, coho, chum biodiversity		
23	Yuutu?it?ath(Ucluelet)/Toquaht	WALLACE CREEK																	Chinook, coho, chum biodiversity		

4.3. Escapement survey review meeting

The 2016 survey results from Areas 21-23 were reviewed at a post-season escapement review workshop held at the Tebo St. DFO office in Port Alberni on February 7, 2017. Workshops participants (Table 4-3) reviewed and discussed the individual survey results and escapement estimates, then collaboratively filled in the commentary for each system that was surveyed. Participants also discussed quality of the observations and classified the estimates according to how they can be used for management purposes. Most of the commentary in the first section of each stream summary was derived from the stream narratives which have been completed by numerous surveyors over the past 20 years.

General trends discussed for Areas 21 to 23 in 2016:

- Very few pinks
- Large Coho everywhere (except for Toquaht, which were small as normal - summer run that enter the system as early as Mother's Day, hold in the lake and spawn in November)
- Better chum year than recent years
- The number of Chinook jacks and jimmies was unusual.

Other comments:

- UFN are interested in surveying Effingham

Table 4-3. Participants at the Area 21-23 escapement review workshop in Port Alberni on February 7, 2017.

Participant	Affiliation
Erica Blake	DFO, Community Advisor
Andrew Campbell	Escapement Contractor
Gary Dagley	DFO, Nitinat Hatchery
Anna Drabosenig*	Ucluelet First Nation
Steve Emmonds	DFO, Robertson Creek Hatchery
Dave Hurwitz	Thorton Creek Enhancement Society
Stephanie King	Sea This Consulting
Scott Kenny	Alberni Valley Enhancement Association (AVEA)
Jim Lane	Nuuchahnulth Tribal Council
Diana McHugh	DFO, South Coast Stock Assessment
Graham Murrell	Hupacasath First Nation
Jeff Till	DFO, South Coast Stock Assessment

* via phone

Figure 4-3. Participants of the Areas 21 to 23 escapement review workshop, February 7, 2017.

5. NITINAT RIVER

5.1. Stream Summary

The Nitinat River flows into the northeast end of Nitinat Lake before flowing into the Pacific Ocean. Nitinat Lake is over 20 km long. Upstream from the lake, the Nitinat River mainstem is over 50 km long but there is a barrier to fish about 18 km upstream from the lake. The survey area is the 17.5 km above the Nitinat Lake (Figure 5-1). Chum, Chinook and Coho spawn in the system in large numbers. The Nitinat Hatchery is a major enhancement facility located about 6 km upstream of the lake.

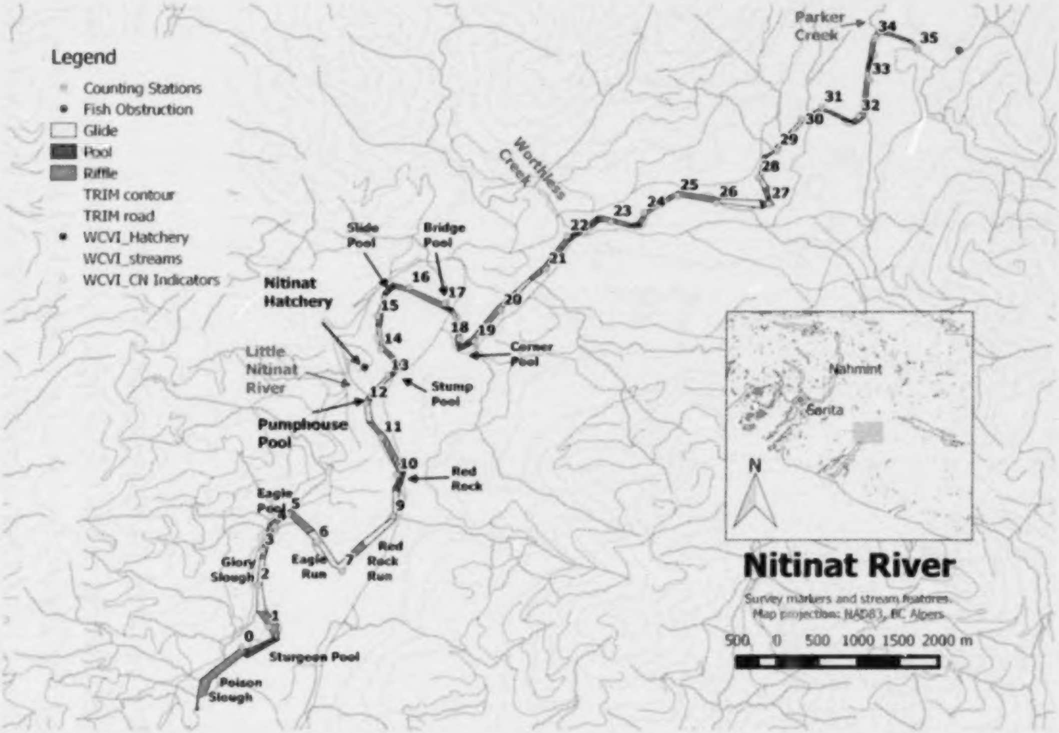

Legend
Counting Stations
Fish Obstruction
Glide
Pool
Riffle
TRIM contour
TRIM road
WCVI_Hatchery
WCVI_streams
WCVI_CN Indicators
Parker Creek
34
35
33
32
31
30
29
28
27
26
25
24
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
7
6
5
3
2
1
0
Worthless Creek
Slide Pool
Bridge Pool
Nitinat Hatchery
Corner Pool
Little Nitinat River
Stump Pool
Pumphouse Pool
Red Rock
Eagle Pool
Glory Slough
Eagle Run
Red Rock Run
Sturgeon Pool
Poison Slough
Nahmint
Sarita
N
Nitinat River
Survey markers and stream features.
Map projection: NAD83, BC Albers
500 0 500 1000 1500 2000 m

Figure 5-1. Nitinat River (above Nitinat Lake) habitat units and survey markers. Map inset show locations of other systems that are regularly surveyed in the area. Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. Habitat data were mapped in the field and / or digitized from recent high resolution orthophotographs by M.C. Wright and Associates Ltd.

5.2. Survey Results and Escapement Estimate

Survey Crew: Keta Biological, Nitinat Hatchery staff
Stock Assessment Biologist: D. McHugh

The Nitinat River was surveyed 3 times in 2016. Four full snorkel surveys of Nitinat were planned to provide a rough estimate of Chum and Chinook for management purposes. Two full surveys and one partial survey were completed due to poor weather conditions. Water levels were too high for swims for much of mid-Oct through mid-November.

Estimate was reviewed with Hatchery staff.

Survey Data:

Table 5-1. Unexpanded live and dead counts by species for each survey, peak live plus dead (PL+D) raw and expanded for OE. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:
For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%; For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

			SK		CO		PK		CM		CN	
Date	**OE cat.**	**Comments**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**
12-Sep*	excellent	Water level below normal, water clear	59								14	
13-Sep**	excellent	Water level below normal, water clear	329		10				4		5976	14
03-Oct**	good	Water level below normal, water slightly turbid	257		1984				2527	163	3205	156
04-Oct*	excellent	Water level below normal, water clear	43		42				742	12	175	14
11-Oct**	poor	Water level above normal, water muddy, only covered the lower river	18		395		1		48209	457	1788	369
		Raw PL+D	328		2,026		1		48,666		6,004	
		Exp PL+D	364		2,532		1		75,897		6,671	

*Upper Nitinat survey: Parker Creek to mid-point
**Lower Nitinat survey: mid-point to lake

Table 5-2. Survey life (SL), adult escapement estimate and rational how the method was applied. Escapement estimates use the OE described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Sp.	Analytical method	SL	First Zero	Last Zero	Annual escapement estimate	Comments	Data quality level
SK							
CO	Expanded PL+D + known removals				2,532 spawners + 2,489 removals = 5,021 total return		2
PK					Adults Present		
CM	EO (range 300-500k) + known removals				425,000 spawners + 145,179 removals = 570,179 total return		2
CN	Expanded AUC (change to EO)	20 (15-25)	Sep 1	Nov 15	12,126 (9,701-16,168) spawners + 7,296 removals = 19,422 total adult return		2

Escapement Commentary:

Sockeye Return:
Higher than the 12 year average, usually see about 100 river sockeye with 50% of the peak usually by June 15, but not nearly as many as 2015 when we saw over 1,300.

Coho Return:
Total return near the 12 year average (~5,500). Coho came in with chinook and kept coming in into December (plus two males in Early Feb). 1550 swim-ins to hatchery, 250 caught in the Lake, 350 in the River; in comparison to 2015 when only 1100 swam in, 0 were caught in the Lake, and 137 were caught in the River, so definitely an improvement over the 2015 return.

Pink Return:
Very low numbers observed, which is typical.

Chum Return:
Above the 12 year average (~150,000), Worthless Creek was full of chum spawners (located about 11.5 km from the lake) indicating a very large return. Survey coverage and quality compromised by poor survey conditions, so the hatchery estimate is recommended. However, based on the large number observed (~50k) during one survey of the lower river in high water with reduced visibility and the extent of the spawners observed by surveyors and hatchery staff, the return was definitely above average with the exact magnitude uncertain.

Chinook Return:
Total return was roughly twice the 12 year average (~10,500), similar to the 2015 return.

5.3. Spawner Distribution

Run Timing:

Table 5-3. The run timing for the survey year by species.

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye					Late Sept	Early Oct	Late Oct
Coho					Early Nov		
Pink							
Chum					Late Sept	Early Oct	Early Nov
Chinook					Late Sept	Early Oct	Early Nov

Comments: Coho peak spawning was not observed, chum spawning was earlier and later than normal due to the large return (expanded the curve).

Spatial Distribution:

Table 5-4. The survey sections used by spawners per species.

Species	Survey Section(s) used for spawning
Sockeye	Parker Creek-bridge
Coho	(Coho typically go up Worthless Creek, not much spawning habitat for other species)
Pink	
Chum	Entire river
Chinook	Entire river

5.4. Environmental Conditions

Weather Summary:	Small rain event in early Sept, brought in fish, high water in mid-Oct the mid-Nov (Nitinat has weather station).
Physical Characteristics Update:	River was fairly stable this year with no blowouts. The river is stabilising.

5.5. Update to Stream Survey Protocols

Current Assessment Method:	Swim 34-0 (Parker Creek to mouth), two crews or two days, split at bridge (17). Aerial survey for peak CM and peak CN when available. Spot check at falls, pools above 34 not normally included in survey section, difficult access, unsafe to survey.
Deviations from current assessment protocols:	No aerial surveys available in 2016. Surveys after early October were cancelled due to high water and poor visibility, so the peak of the chum may have been missed.
Access and safety updates:	None reported

5.6. Enhancement

Brood Removal:

- Coho: 712 taken for broodstock. 668 (333 males, 334 females, 1 jack) taken from hatchery swim-ins and 44 taken from the river (22 males, 22 females).
- Chum: 21,816 taken for broodstock. 16,320 (5,508 males, 10,812 females) taken from hatchery swim-ins and 5,496 taken from the lake (891 males, 4,605 females).
- Chinook: 2,483 taken for broodstock. 273 (165 males, 106 females, 2 jacks) taken from hatchery swim-ins, 466 (196 males, 270 females) taken from the lake, and 1,744 (810 males, 934 females) taken from the river.

5.7. Biosamples

Assessment Objectives

Chinook:

- Currently, these fish are all thermally marked differentially between production and semi-natural rearing regimes. They have been thermally marked since 1992.
- Returns from semi-natural rearing strategies brood year have been compared with returns from a production rearing strategy since 2004 brood year, using thermal marking.
- DNA, otolith and scales samples are being taken from 200 fish for a straying study.
- DNA is being collected from 100 jacks returning from 2013 PBT.

Chum: sampled (normal samples 200 scales and otoliths) to assess hatchery contribution.

Coho: sampled (otoliths, DNA, lengths, no scales) for assessing hatchery component.

Coho:

- Coho sex ratio based on the swim-ins, was 52% female, which is higher than average. The 2015 swim-ins were only 40% female.
- 92% of swim-ins were hatchery marked
- Hatchery ratio in the river samples collected early was 45%. The overall ratio was likely a bit lower (~40%) because the hatchery component returns a bit earlier than the wild.
- Jack ratio from the swim-ins was 3.3%

5.8. Concerns and Comments

Sampling sheets were cumbersome, keep trying to streamline.

There were a lot of fishermen this year (a meat fishery).

Some Coho may have been misidentified by the swimmers as Chinook while they were still silver bright because they were unusually large this year and Chinook were fairly abundant early on.

The hatchery also estimated roughly 5,000 total Coho return based on a reconstruction of the hatchery return expanded by the proportion wild in-river (2,000 total hatchery return/40% hatchery in-river = 5,000 total adult return).

6. HOBITON CREEK

6.1. Stream Summary

Hobiton Creek drains Hobiton Lake into Nitinat Lake. There are records of Sockeye, Coho and Chum salmon in the Creek. The fence was operated from May 6 until July 9. No fish were yet showing at the mouth of the river when the fence was installed. Fish were still moving through the fence in early July.

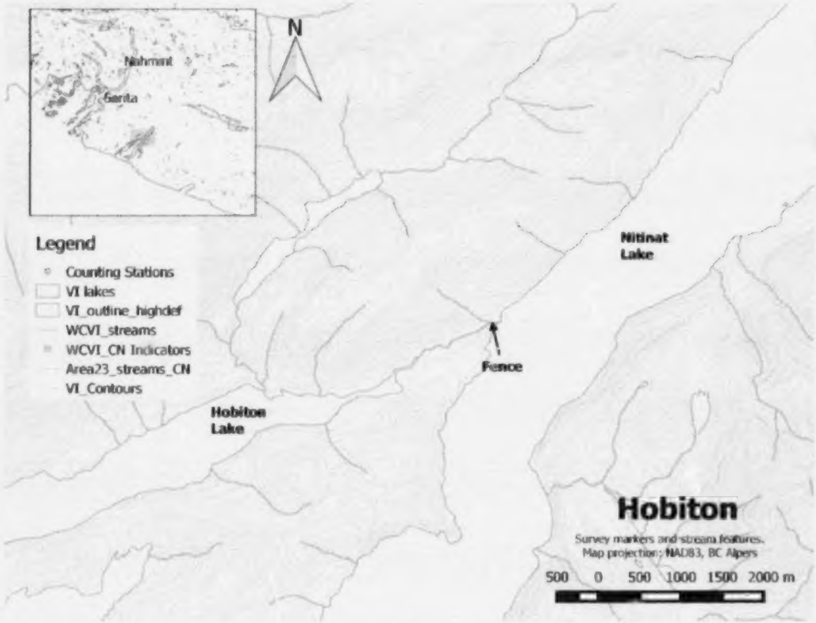

N
Nahmint
Sarita
Legend
Counting Stations
VI lakes
VI_outline_highdef
WCVI_streams
WCVI_CN Indicators
Area23_streams_CN
VI_Contours
Nitinat Lake
Fence
Hobiton Lake
Hobiton
Survey markers and stream features.
Map projection: NAD83, BC Albers
500 0 500 1000 1500 2000 m

Figure 6-1. Hobiton Creek counting fence. Map inset show locations of other systems that are regularly surveyed in the area. Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia.

6.2. Escapement Estimates

Survey Crew: Ditidaht First Nation (Perry Edgar)
Stock Assessment Biologist: Jim Lane (NTC)

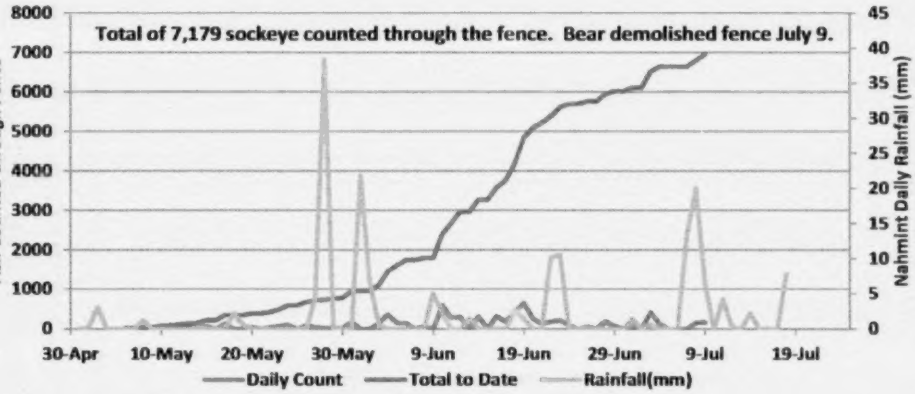


Figure 6-2. Sockeye counted at the Hobiton fence in spring and summer 2016.

6.3. Escapement Comments

SK: Total count through the fence was similar to last year. It was a good year for Hobiton escapement for that time period, although still way below what was typical in the late 70s' and 80's. (Type 2- consistent proportion, but misses the early portion, and sometimes the tail. Good count during the peak)

CM: Nitinat Hatchery staff estimated roughly 8,000 Chum spawned in Hobiton.

6.4. Environmental Conditions

The environmental conditions were similar to the rest of the region, started off drier and warmer than usual up to the end of May, then turned around to be a typical late spring summer pattern of cool wet June and beginning of July. The dryer conditions in April and May provided good water levels for fence installation and operation without washouts that typically occur in May.

6.5. Survey Protocols

Fence using mechanical counters installed by Ditidaht Fisheries Department with the assistance of NTC. 16 calibration counts occurred with an average calibration of 1.03. So based on the calibrations, for every 100 fish counted 103 fish actually entered the system on average. Biosamples weren't collected because they don't get analysed. DFN have strict rules for harvesting SK, have a good relationship with C&P.

7. CHEEWHAT

7.1. Stream Summary

The Cheewhat System is located in Area 21 and in the traditional territory of the Ditidaht First Nation. The Cheewhat River drains Cheewaht Lake and flows southwest into the Pacific Ocean, to the south of Nitinat Lake. There are five small (2-5 m in width) tributaries that feed Cheewhat Lake (S1 S2, S3, S4 and S5; Figure 7-1). The system has records of spawning Sockeye, Chum and Coho. The S2 tributary has the largest Sockeye population and is the only tributary accessible by foot from the Rosander Main logging road. About 200 m up from the lake S2 branches into S1 and S2.

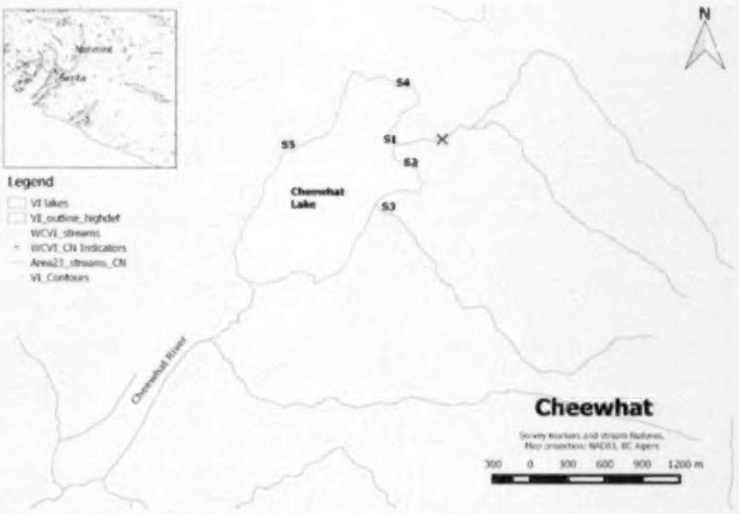

N
S4
S5
S1
S2
S3
Cheewhat Lake
Cheewhat River
Legend
VI lakes
VI_outline_highdef
WCVI_streams
WCVI_CN Indicators
Area23_streams_CN
VI_Contours
Cheewhat
300 0 300 600 900 1200 m

Figure 7-1. The Cheewhat System. The x on S2 is the location of the anadromous barrier. Roads, rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia.

7.2. Escapement Estimates

Survey Crew: Phillip, Leslie Lauder
Stock Assessment Biologist: Jim Lane (NTC)

7.3. Escapement Comments

The Cheewhat survey occurred twice (saw a few SK and CO), and end of Oct 2nd week of Nov peak of SK spawn.

7.4. Environmental Conditions

7.5. Survey Protocols

Surveys are done as stream walks from the lake to the anadromous barrier

8. SARITA RIVER

8.1. Stream Summary

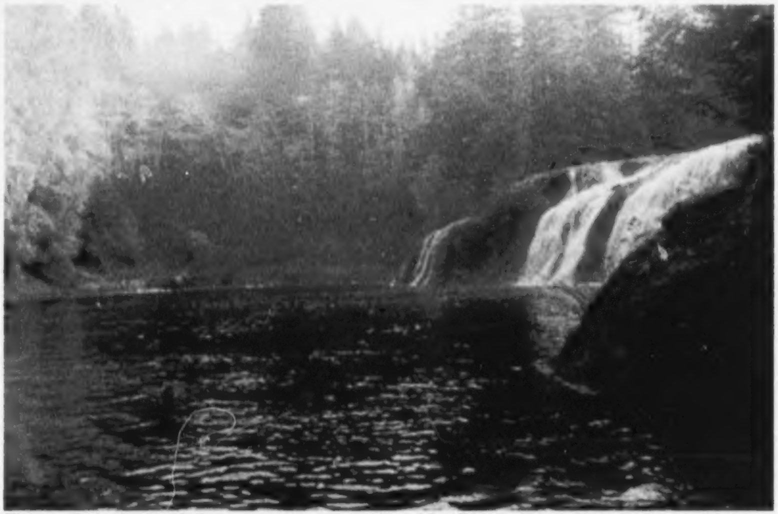


Figure 8-1. Sarita falls near survey marker 12. Photo taken by surveyor Andrew Campbell on Oct. 20, 2015.

The Sarita River flows southwest and northwest into Numukamis Bay, East of Tzartus Island in the Barkley (Sound) Land District. The lower river is fed by Sarita Lake, located about 9 km upstream from the estuary, but only the lower 8 km is accessible to salmon because of a series of falls that are impassible to fish (Figure 8-1). The 6 km below the falls is the survey area and has been divided into 12 – 500 m long sections that are used for salmon enumeration (Figure 8-2). The marker farthest downstream is markers 0 and is located just above the tidal area in the river. The South Sarita is the main tributary that joins the Sarita about 2.5 km upstream from marker, between survey markers 4 and 5. The South Sarita does not usually connect to the Sarita until October and may be used occasionally by spawning salmon. Surveyors spot check the South Sarita from the bridge but do not survey the tributary.

There is abundant gravel and several deep pools on the Sarita, although surveyors report that the pools are filling in, especially in the lower river. The Corner Pool between survey markers 3 and 4 is estimated to be 6 to 8 m in depth and the deepest in the survey area. Other pools include one at Blenheim Bridge and another below the falls at marker 12. There is a trestle above marker 9 and a cable car above marker 2. Around survey marker 11 the habitat is complex and the channel splits in several spots. Near marker 2 there is a big log jam and between markers 2 and 0 there are gravel banks that have experienced considerable erosion in the past several years. In recent years, surveyors have reported the high bank around marker 5 is also eroding. Salmon spawn around markers 3 and 6, above 9, and between 11 and 12.

Sarita is a lake moderated system, unregulated by a dam and is prone to flashy flows where the water level can come up by 6 metres overnight. High water is retained for longer because of the lake and after heavy rain the river takes a couple of days to clear, often several days longer than the Nahmint. After the first rains in the fall the system stays tea-coloured for the rest of the year. The pools, which Chinook use for holding, often have higher turbidity. Compared to the mainstem, the South Sarita stays relatively clear. The river temperature can be relatively warm early in the spawning season and cause fish stress. The South Sarita is always a cooler then the mainstem.

There are often bears, eagles and other birds observed on the river during spawning season. Seals are often seen in the estuary and occasionally in the system all the way to Blenheim Bridge (between markers 6-5).

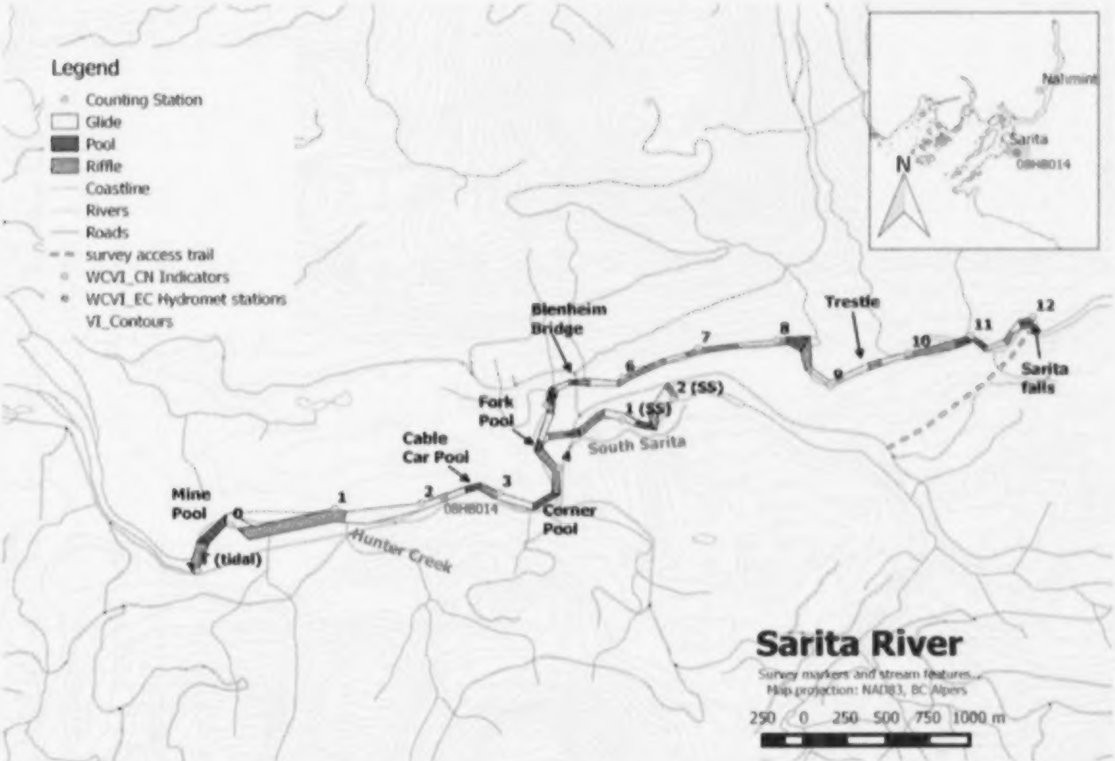

Legend
Counting Station
Glide
Pool
Riffle
Coastline
Rivers
Roads
survey access trail
WCVI_CN Indicators
WCVI_EC Hydromet stations
VI_Contours
Nahmint
Sarita
08HB014
N
Blenheim Bridge
Trestle
12
11
10
9
8
7
6
Sarita falls
2 (SS)
1 (SS)
Fork Pool
South Sarita
4
Cable Car Pool
3
2
1
0
Mine Pool
T (tidal)
08HB014
Corner Pool
Hunter Creek
Sarita River
Survey markers and stream features
Map projection: NAD83, BC Albers
250 0 250 500 750 1000 m

Figure 8-2. Sarita River habitat units and survey markers. Roads, rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. Habitat data were mapped in the field and / or digitized from recent high resolution orthophotographs by M.C. Wright and Associates Ltd. The orange marker shows the location of the Environment Canada hydromet station at Sarita (08HB014).

8.2. Survey Results and Escapement Estimate

Survey Crew: Keta Biological/ Huu-ay-aht First Nation Fisheries (A. Campbell/Amelia Vos)
Stock Assessment Biologist: D. McHugh

The Sarita River was snorkel surveyed 7 times in 2016.

Survey Data:

Table 8-1. Unexpanded live and dead counts by species for each survey, peak live plus dead (PL+D) raw and expanded for OE. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:
For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%; For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

			SK		CO		PK		CM		CN	
Date	**OE cat.**	**Comments**	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
07-Sep-16	excellent	Water level below normal (1.459m) and slightly turbid (8.5-9m)	6		15				2		1186	
15-Sep-16	excellent	Water level below normal (1.390m) and clear (12.5m)	15		49				1		1045	
21-Sep-16	excellent	Water level below normal (1.502m) and clear (12-15m)	9		373				43		1268	
30-Sep-16	excellent	Water level below normal (1.429m) and clear (12m)	67		500				344	3	1200	71
12-Oct-16	fair	Water level above normal (1.668m) and muddy (5-6m), poor visibility in pools	6		456				4863	206	1224	74
01-Nov-16	poor	Water level above normal (1.9m) and muddy (3.5-4m)			3				13999	12034		
		Raw PL+D	67		500		0		26,033		1,298	
		Exp PL+D	74		702		0		32,541		1,997	

Table 8-2. Adult escapement estimate and parameters [Survey Life (SL) and first and last zeros if the AUC method was used]. Escapement estimates use the OE described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Sp.	**SL**	**First Zero**	**Last Zero**	**Comments**	**Annual escapement estimate**	**Analytical method**	**Data quality level**
SK	NA				74	Expanded PL+D	2
CO	25 (20-30)	01-Sep	01-Dec	Last two surveys not included in AUC due to poor survey conditions, average SL	1,247 (1,040-1,559)	Expanded AUC	2
PK	NA				None Observed		
CM	12.5 (10-20)	01-Sep	01-Dec	Lower SL range applied due to pattern of entry. High peak followed by rapid die-off.	34,133 (28,444-42,666)	Expanded AUC	2
CN	20 (15-25)	01-Sep	01-Nov	Average SL	2,359 (1,827-3,246) + 302 removals = 2,661 total return	Expanded AUC	2

Escapement Commentary:

SK return:	Similar to numbers observed in the past few years (50-100)
CO return:	Near 12 year average, large coho individuals (healthier than last years, "huge", consistent with observations in other areas of large coho)
PK return:	None observed
CM return:	Above the 12 year average, normal sized just lots of them
CN return:	Above the 12 year average, normal sized

HFN did a bunch streamwalks (Sugsaw – no fence this year, but stream walks, in rough notes). There is a good stream narrative; has been work on spawning platforms.

8.3. Spawner Distribution

Run Timing:

Table 8-3. The run timing for the survey year by species.

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye					Mid Sept	Early Oct	Mid Nov
Coho					Mid Oct		
Pink							
Chum					Late Sept	Late Oct	Early Nov
Chinook					Mid Sept	Mid Oct	Late Oct

Comments: Surveys ended before peak Coho spawning occurred. All species were present in the stream when surveys started

Spatial Distribution:

Table 8-4. The survey sections used by spawners per species.

Species	Survey Section(s) used for spawning
Sockeye	12-9, 3-1
Coho	12-10, 9-8
Pink	
Chum	12-0,
Chinook	12-0, Majority of spawning occurring between 12-7
Steelhead	

Comments: Peak spawning of Coho was not observed. Similar to previous years.

8.4. Environmental Conditions

Weather Summary: Heavy rains during October prevented surveys to be conducted as scheduled. Only one survey was conducted in October.

Physical Characteristics Update: Extensive erosion, pool below the Blenheim Bridge bank is being eaten away, active logging above the corner pool – pool is filling in and visibility is poor. The Mine Pool is filling in with silt/mud, fish no longer hold there (not seen there for the last few years). More fish seen holding in Hunter Pool.

8.5. Update to Stream Survey Protocols

Current Assessment Method: Survey begins at Sarita Falls (marker 12) and ends at marker zero (just above the mine pool). Vertical visibility and temperature were taken at the falls pool. Horizontal visibility is recorded at the run between 11-10, and at Blenheim Bridge. Discharge is recorded by Environment Canada and available online (https://wateroffice.ec.gc.ca/report/report_e.html?type=realTime&stn=08HB014)

Deviations from current assessment protocols: None

Access Updates: None

Safety Update: None

8.6. Enhancement

Chinook brood removal: 218 taken for broodstock from the river (114 males, 104 females).

8.7. Biosamples

100 jimmy Chinook were sampled: All were hatchery fish, 82% were from the Sarita Traditional Large release group, 18% were from the Sarita Enriched Large release group. 0% from each of the other release groups (Small Trad, Small Enriched).

The sex ratio based on first set information from the hatchery was 68.5% males, 31.5% females. (excluding jimmies, didn't see any jacks)

Of the 236 otoliths submitted, 84% were hatchery origin, but all were Sarita stock. (Not including jimmies)

8.8. Concerns and Comments

High water in October caused extensive erosion on the bank below the bridge. Logging and road work around the corner pool has also caused extensive erosion, visibility in the corner pool has been negatively affected.

A large number of jimmies were observed this year, usually we don't see any.

Bear got into the holding pond at Nitinat and ate ~20 females, lost quite a few eggs.

9. NAHMINT RIVER

9.1. Stream Summary

The Nahmint River flows southeast into Nahmint Bay in Alberni Inlet. The lower Nahmint drains out of Nahmint Lake which is located 11.7 km upstream from the estuary. There is a steep canyon about 3.5 km upstream from the mouth (between markers 7 and 8), which was historically thought to be an obstruction to migration, but salmon are occasionally observed above the canyon. The mainstem below the canyon has been divided into 6 – 500 m sections for salmon enumeration. Historically, the survey started in the upper reaches above the canyon and ended at marker 0 in the tidal area. In recent years the survey starts just above marker 6 and ends at marker 1 which is the upper extent of the salt water (Figure 9-1).

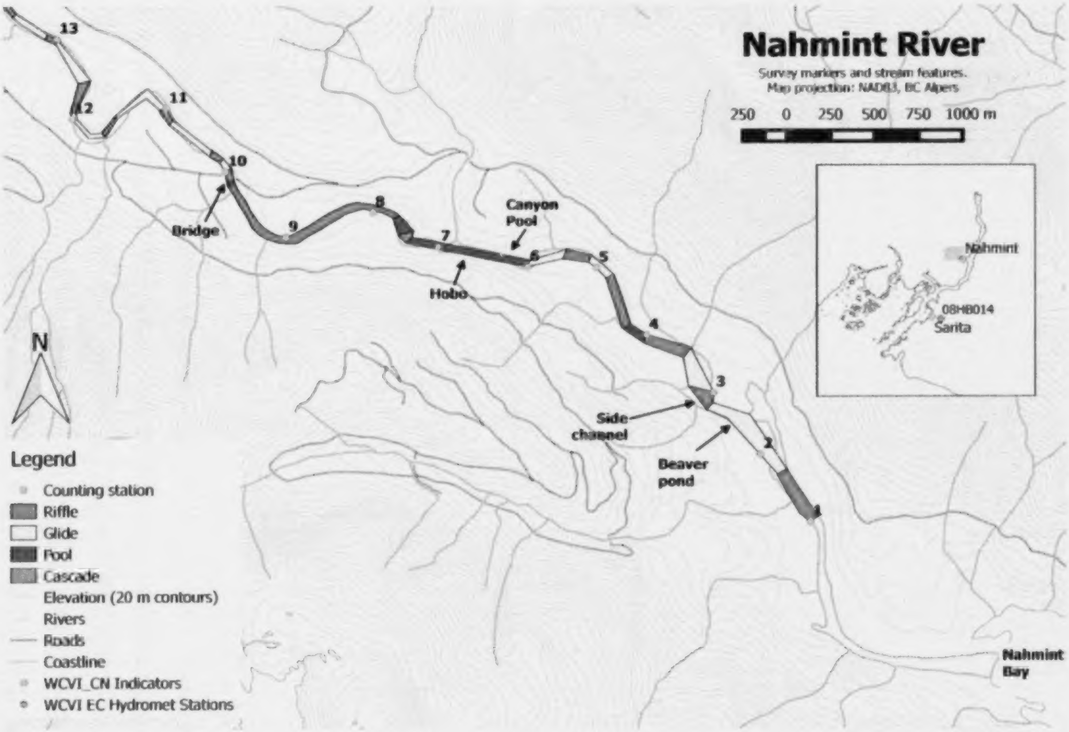

Nahmint River
Survey markers and stream features.
Map projection: NAD83, BC Albers
250 0 250 500 750 1000 m
13
12
11
10
Bridge
9
8
7
Hobo
Canyon Pool
6
5
4
3
Side channel
Beaver pond
2
1
Nahmint Bay
Nahmint
08HB014
Sarita
N
Legend
Counting station
Riffle
Glide
Pool
Cascade
Elevation (20 m contours)
Rivers
Roads
Coastline
WCVI_CN Indicators
WCVI EC Hydromet Stations

Figure 9-1. Nahmint River habitat units and counting stations. Roads, rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. Habitat data were mapped in the field and / or digitized from recent high resolution orthophotographs by M.C. Wright and Associates Ltd. The Beaver Pond largely filled in with silt and gravel as of 2014. Map inset shows the location of the nearby Sarita River as well as the location of the Environment Canada hydromet station at Sarita (08HB014).

The stream has two small tributaries; one is an unnamed tributary just upstream of survey marker 1, and the other is Canyon Creek just below survey marker 7. Both tributaries are considered suitable fish habitat, but have no record of fish observations. The river habitat is characterized by several deep, wide pools, riffles and several fast flowing rapids. There tends to be a lot of clay in the system. Stream features include the Beaver Pond between markers 2 and 3, the side channel at marker 3, and the canyon pool between markers 6 and 7 (Figure 9-2).

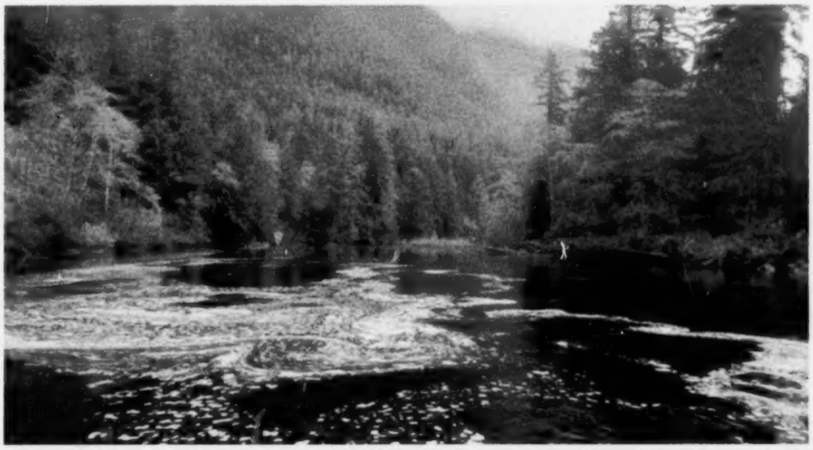


Figure 9-2. Photo of the Nahmint River looking downstream from the Canyon Pool at marker 7. Photo taken by Andrew Campbell in October 2015.

Similar to the Sarita River, Nahmint is a lake moderated system, unregulated by dam, and is prone to flashy flows where the water level can come up by 6 metres overnight. High water is retained for longer because of the lake and after heavy rain the river takes a couple of days to clear. The time to clear has increased in recent years due to higher sediment loads from logging. The stream clears more quickly than the Sarita. Nahmint is the coolest river in the area in the summer-time.

Many species are found in the area during spawning periods (i.e. bears, eagles, seagulls and seals). Seals are often observed in high numbers in the estuary and in the lower reaches of the river during surveys.

The Chinook population has been enhanced by the Robertson Creek Hatchery when sufficient broodstock can be collected (since the 1980s).

9.2. Survey Results and Escapement Estimate

Survey Crew: Keta Biological (A. Campbell, C. Mack)
Stock Assessment Biologist: D. McHugh

The Nahmint River was snorkel surveyed 7 times in 2016. Surveys through September and most of October occurred as scheduled, however survey quality in October was reduced due to a series of major rain events and the mid-October surveys had to be delayed. Coverage of Chinook and Coho returns was good, but the peak of the Chum return was likely missed.

Survey Data:

Table 9-1. Unexpanded live and dead counts by species for each survey, peak live plus dead (PL+D) raw and expanded for OE. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:
For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%; For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 30%

			SK		CO		PK		CM		CN	
Date	**OE cat.**	**Comments**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**
02-Sep-16	excellent	Water level normal (0.56m), water clear (10 m)	75								55	
09-Sep-16	excellent	Water level below normal (0.64m), water clear (10-12m)	521		13				2		145	
16-Sep-16	excellent	Water level below normal (0.57m), water clear (15-15.5m)	621	1	43				7		172	1
22-Sep-16	excellent	Water level below normal (0.64m), water clear (15-17m)	378		226				160	1	243	
30-Sep-16	excellent	Water level below normal (0.615m), water clear (12m)	796		186		1		591	2	158	4
06-Oct-16	fair	Water level above normal (0.868m), water slightly turbid (12m)	882		260				1562	18	238	4
12-Oct-16	fair	Water level above normal (0.92m), water slightly turbid (8.8m)	940		117				13080	200	465	30
31-Oct-16	poor	Water level at flood (1.1m), water muddy (6.5-6m)	11		20				5712	1955	2	
		Raw PL+D	940		260		1		13,280		495	
		Exp PL+D	1,446		400		1		16,600		762	

Table 9-2. Survey life (SL), adult escapement estimate and comments on how the method was applied. Escapement estimates use the OE described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Sp.	SL	First Zero	Last Zero	Comments	Annual escapement estimate	Analytical method	Data quality level
SK	25 (20-30)	Aug 20	Nov 15	Oct 31 survey not included in AUC due to poor survey conditions. Significant number observed during first survey (Sep 2), so first zero pushed back.	2,223 (1,852-2,778)	Area Under the Curve	2
CO	25 (20-30)	Sep 1	Dec 15	Oct 31 survey not included in AUC due to poor survey conditions.	493 (411-616)	Area Under the Curve	2
PK					Adults Present		2
CM	15 (10-20)	Sep 1	Nov 15	Standard values, sufficient water for normal timing	22,975 (17,231-34,462)	Area Under the Curve	2
CN	20 (15-25)	Sep 1	Nov 15	Standard values, sufficient water for normal timing	847 (678-1,129)	Area Under the Curve	2

Jim Lane: SK come in and are done around the end of Oct, they don't come in and hold for long periods like some of the other populations in the area. So we may want to use the Oct 31 survey.

Escapement Commentary:

SK return:	High relative to the 12 year average (~750), but similar to the 2015 estimate. Pretty good numbers compared to what is typically seen. Their production seems to be tracking the Lake-type SK. They cannot access the lake.
CO return:	Close to the 12 year average (~420), an increase relative to the 2015 estimate.
PK return:	A few adults observed, consistent with previous years.
CM return:	Above the 12 year average (~15,000), and an increase compared to 2015.
CN return:	Above the 12 year average (~300), and an increase compared to 2015. With all the strays, Nahmint is the coolest river in the summer-time, so fish holding in Alberni canal are attracted to the cool water leading to more strays particularly early in the season.

9.3. Spawner Distribution

Run Timing:

Table 9-3. The run timing for the survey year by species.

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye					Mid Sept	Mid Oct	Late Oct
Coho					Late Sept		
Pink							
Chum					Mid Sept	Early Oct	Early Nov
Chinook					Mid Sept	Early Oct	Late Oct

Comments: Coho peak spawn not observed. Summer steelhead can get up to the lake, the barrier just below the lake blocks the other species.

Spatial Distribution:

Table 9-4. The survey sections used by spawners per species.

Species	Survey Section(s) used for spawning
Sockeye	7-1
Coho	7-1
Pink	
Chum	7-1
Chinook	7-1, especially between 5-6, in riffles below 4 and 4
Steelhead	

Comments: Spawners observed in all sections, same as last year.

9.4. Environmental Conditions

Weather Summary:	Physical Characteristics Update: Fallen trees above the beaver pool have been pushed out of the river. The entrance to the beaver pond continues to expand, and gravel and silt that had been filling the beaver pond in previous years is being flushed out.
Physical Characteristics Update:	None reported.

9.5. Update to Stream Survey Protocols

Current Assessment Method:	Two trucks are required. One parked at the entrance and one at the exit. At the entrance follow the trail down to the canyon pool to start the survey. Exit at marker 2 and follow the trail back to the road.
Deviations from current assessment protocols:	New stream markers have been hung to better mark the survey sections on the river.
Access Updates:	Trail in and out of the river have been marked with orange paint.
Safety Update:	The entrance to the Beaver Pond is safer due to the widening of the entrance.

9.6. Enhancement

Brood Removal: 73 chinook removed for brood

9.7. Biosamples

Age	Nahmint	Sarita	Robertson	Gold	Conuma	Not Marked	Total
31	9.1%	9.1%	9.1%	9.1%	0.0%	63.6%	11
41	30.9%	3.6%	0.0%	0.0%	3.6%	61.8%	55
51	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	1
	26.9%	4.5%	1.5%	1.5%	4.5%	61.2%	67

9.8. Concerns and Comments

- Nahmint HOBO is down. (Last updated Dec 22nd).
- The bridge RBH uses (at Macktush) was taken out, so the hatchery staff had to drive over the top, made the transport of adults difficult.
- Seals and sealions still in Nahmint; hatchery sees fish with damage.

10. CLEMENS CREEK

10.1. Stream Summary

Clemens Creek flows southwest into the top end of Henderson Lake. The mainstem is over 12 km long. It is primarily a Sockeye and Coho system but Chum and Chinook are also present. The survey length is 4.7 km. Extensive surveys of the accessible length in previous years found that the majority of fish utilized the area surveyed with a few utilizing a couple of pools a kilometer above the survey section. Spot checks of those pools are conducted occasionally, particularly early in the season.

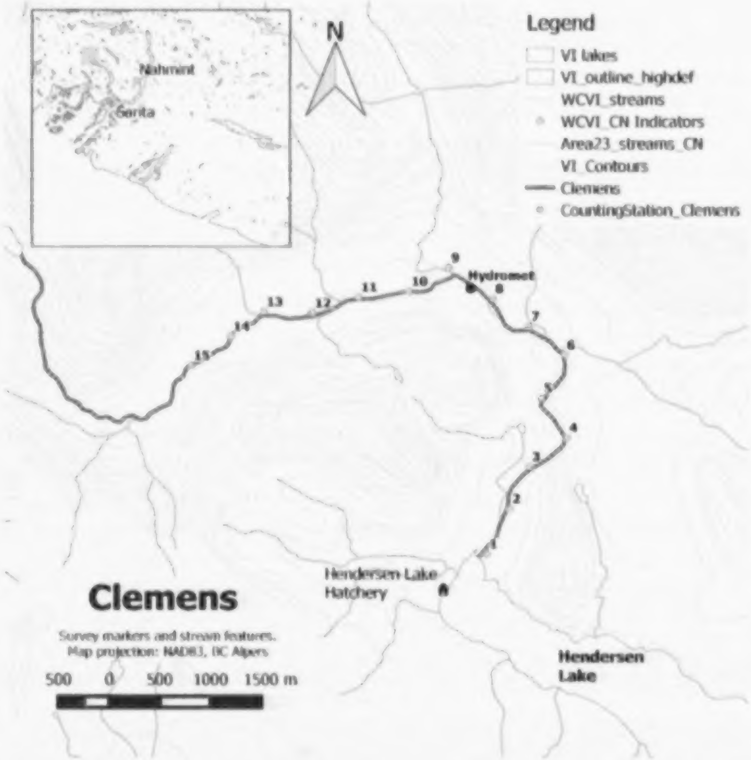

Nahmint
Sarita
N
Legend
VI lakes
VI_outline_highdef
WCVI_streams
WCVI_CN Indicators
Area23_streams_CN
VI_Contours
Clemens
CountingStation_Clemens
9
Hydromet
8
7
6
5
4
3
2
1
10
11
12
13
14
15
Hendersen Lake Hatchery
Hendersen Lake
Clemens
Survey markers and stream features.
Map projection: NAD83, BC Albers
500
0
500
1000
1500 m

Figure 10-1. Clemens Creek. Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia.

10.2. Survey Results and Escapement Estimate

Survey Crew: M.C. Wright and Associates Ltd. (I. Wright, R. Abbott)
Stock Assessment Biologist: D. McHugh

Clemens Creek was snorkel surveyed 11 times in 2016. A majority of Henderson Sockeye spawn in Clemens Creek. Henderson Sockeye are harvested in the Somass Sockeye fishery. The Somass fishery is managed to avoid Henderson Sockeye due to the lower productivity of Henderson Lake relative to Great Central and Sproat, but a solid estimate of escapement is required to evaluate whether the fishery remained within the exploitation rate limits. Based on the historical observations, Sockeye may peak in Clemens Creek in late September or not until mid-November, so we conduct weekly surveys throughout the season to ensure we have a good handle on run timing and abundance.

Survey Data:

Table 10-1. Unexpanded live (L) and dead (D) counts by species for each survey, peak live plus dead (PL+D) raw and expanded for OE. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:
For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%; For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

Date	OE cat.	Comments	SK		CO		PK		CM		CN	
			L	D	L	D	L	D	L	D	L	D
24-Aug	Excellent	Water Level extremely low, Gauge height 0.327 m (Lake staff gauge -0.00m. Water temperature was 13.5°C (22°C in lake). Very low water levels potentially limiting access and contributing to low abundance. Dewatered at 5-1 in mainstem and side channel	134									
07-Sep	Excellent	Water Level below normal, Gauge height 0.487 m (Lake staff gauge 0.4 m. Water temperature was 12.0°C (20°C in lake). Water was at a normal level after rains 5 days earlier	249		97							
12-Sep	Excellent	Water Level below normal, Gauge height 0.41 m (Lake staff gauge 0.31 m. Water temperature was 11.0°C (21°C in lake). Noticed numerous large schools of stickleback in the lake, do not recall seeing this in previous years	313		174							
20-Sep	Good	Water Level normal, Gauge height 0.585 m (Lake staff gauge 0.44 m. Water temperature was 11.0°C (18°C in lake).	743	1	697				4		13	
28-Sep	Excellent	Water Level below normal, Gauge height 0.445 m (Lake staff gauge 0.325 m. Water temperature was 10.0°C (18.5°C in lake).	1636		899				28		24	
03-Oct	Excellent	Water Level normal, Gauge height 0.490 m. Water temperature was 9.75°C (18.0°C in lake). Very poor visibility in lake. There was ~25mm of rain 36hrs prior.	2525		934				45		15	1
11-Oct	Good	Water Level normal, Gauge height 0.61 m (Lake staff gauge 0.775 m). Water temperature was 8°C (15.5°C in lake).	5565		1134				150		34	
17-Oct	Fair	Water Level above normal, Gauge height 0.900 m (Lake staff gauge 1.55 m). Water temperature was 9.5°C (13.5°C in lake).	3262	3	1183				171		11	
24-Oct	Fair	Water Level normal, Gauge height 0.83 m (Lake staff gauge 1.13 m). Water temperature was 9.0°C (12.5°C in lake).	3040	148	1343				90		1	
31-Oct	Good	Water Level normal, Gauge height 0.779 m (Lake staff gauge 1.055 m). Water temperature was 9.0°C	1932	513	1010	1			68	4	1	
14-Nov	Good	Water Level normal, Gauge height 0.94 m (Lake staff gauge 1.7 m). Water temperature was 9.5°C (11.0°C in lake).	16	12	130	13			6			
		Raw PL+D	5,565		1,343				171		34	
		Exp PL+D	6,956		2,066				214		42	

Table 10-2. Survey life (SL), adult escapement estimate and rational how the method was applied. Escapement estimates use the OE described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Sp.	SL	First Zero	Last Zero	Comments	Annual escapement estimate	Analytical method	Data quality level
SK	14.5 (11-18)	Aug 23	Dec 1	Survey Life based on the historical relationship between the raw survey counts and escapement estimate.	9,681 (7,798-12,761)	Area Under the Curve	2
CO	35 (30-40)	Aug 24	Dec 1		2,128 (1,862-2,483)	Area Under the Curve	2
PK							
CM	15 (10-20)	Sept 12	Nov 20	First zero observed	318 (238-477)	Area Under the Curve	2
CN	17.5 (10-25)	Sept 12	Nov 14		48 (33-83)	Area Under the Curve	2

General comment on escapement estimate: We may want to separate the lake component (Jim Lane).

Additional Data

A fence was installed by Uchucklesaht with assistance from NTC and Maa-nulth in the Henderson River from June 23 to September 14. Four mechanical flappers installed to count fish as they move through. The counters should be calibrated frequently to ensure the flappers are accurately counting fish through as well as verifying species composition. Five calibrations occurred in August.

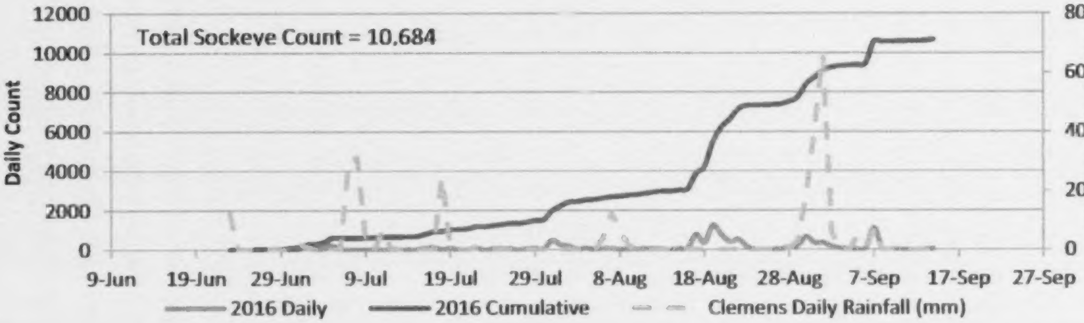


Figure 10-2 Counts from the mechanical flappers on the fence on the Henderson River in 2016. Based on the available calibrations: 10,684 sockeye moved through the fence.

Escapement Commentary:

SK return:	Much improved compared to the 2015 return. Spawning was observed along the beach as well as in Clemens Creek.
CO return:	Close to the 12 year average (~1,200)
PK return:	None observed
CM return:	Above the 12 year average (~120)
CN return:	Below the 12 year average (~120), but within the normal range as chinook returns to Clemens Creek have been quite variable in recent years.

Run Timing:

Table 10-3. The run timing for the survey year by species. N.O. stands for none observed.

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye					Early Sept	Mid Oct	Early Nov
Coho				Early Sept	Mid Oct		
Pink							
Chum				Mid Sept	Early Oct	Late Oct	Early Nov
Chinook				Mid Sept	Mid Oct	Mid Oct	Late Oct

Spatial Distribution:

Table 10-4. The survey sections used by spawners per species.

Species	Survey Section(s) used for spawning
Sockeye	9-0, Lake
Coho	9-5, 2-1
Pink	
Chum	1-0
Chinook	Run times were recorded, but no spawning was observed

Peak Coho spawning not observed.

10.3. Environmental Conditions

Weather Summary: None reported

Physical Characteristics Update: Bank failure in spawning channel @ CS1 – several large trees uprooted.

10.4. Update to Stream Survey Protocols

Current Assessment Method: The standard survey area this year was from counting station 9-2 all the way to the hatchery, including the lake shoreline from the mouth of Clemens Creek to the hatchery. This survey takes between 4 to 6 hours depending on flows and number of fish present. Environmental measurements are collected at the bridge (visibility and temperature) and in the lake near the hatchery (temperature).

Deviations from current assessment protocols: No deviations from last year's assessment protocols occurred.

Access Updates: The river was accessed from the road near counting station 9-0, which entailed a short (approximately 50m) bushwhack down to the river. Access has not changed from previous years.
Note that active hauling was occurring this year, so swimmers had to ensure vehicles were parked far enough off the road to allow off-road logging trucks to pass.
There is a new gate on Clemens mainline, just past the Bridge where the HOBO is, will need the key.

Safety Update: No significant changes – the log jams in counting sections 5-6 and 8-9 continue to be hazardous during higher flows.

10.5. Enhancement

No enhancement activities in 2016.

10.6. Biosamples

SK samples from the fence were 93% 5_2s, and 7% 4_2s.

SK samples from the gillnet fishery in Uchucklesaht Inlet were 91% 5_2s, 2% 5_3s, and 7% 4_2s

10.7. Concerns and Comments

Age distribution tracked the Somass distribution of high to five-year olds. Saw a lot of the henneguya (salmon parasite), ~75% of the later fence samples were affected. Seems to be a higher incidence this year. (Parasite used to be used as an indicator of Stock ID (Henderson) in mid-80s.)

11. TOQUAHT RIVER

11.1. Stream Summary

The Toquaht River flows south into Toquaht Bay on the northwest edge of Barkley Sound. The mainstem is about 10 km up to Toquaht Lake. The main tributary is the Little Toquaht River which enters the Toquaht about 500 m upstream from the mouth. The Little Toquaht River drains Little Toquaht Lake which is located about 3 km upstream from the confluence. The Toquaht has a moderate gradient and about 4 km upstream from the mouth is a set of cascades which are a barrier to Chum under some conditions. The Thornton Creek Hatchery has been enhancing the Toquaht and other streams in the area since the late 1970s.

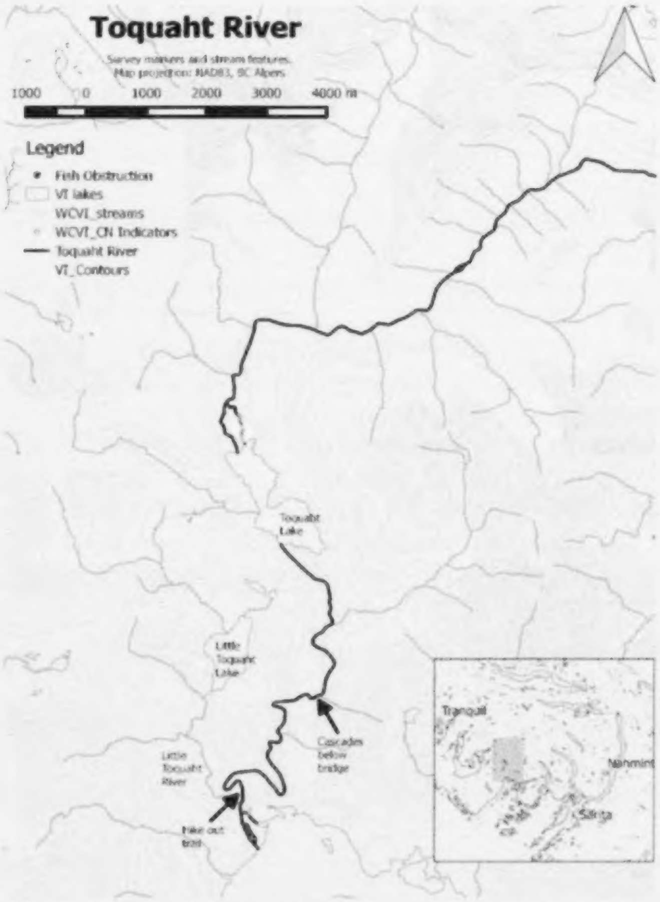

Toquaht River
Survey markers and stream features.
Map projection: NAD83, BC Albers
1000
0
1000
2000
3000
4000 m
Legend
● Fish Obstruction
VI lakes
WCVI_streams
WCVI_CN Indicators
Toquaht River
VI_Contours
Toquaht Lake
Little Toquaht Lake
Little Toquaht River
Cascades below bridge
Hike out trail
Tranquil
Nahmint
Sarita

Figure 11-1. The Toquaht System. Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia.

11.2. Survey Results and Escapement Estimate

Survey Crew: TCES (Doug Palfrey, Dave Hurwitz)
Stock Assessment Biologist: Diana McHugh

The lower Toquaht was surveyed twice in September to provide some information regarding the Chinook return. The surveys were too early to catch the Chum peak. The upper Toquaht (the river above Toquaht Lake) was surveyed in mid-November to provide an indication of Coho abundance.

Survey Data:

Table 11-1. Unexpanded live (L) and dead (D) counts by species for each survey, peak live plus dead (PL+D) raw and expanded for OE. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:
For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%; For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

			SK		CO		PK		CM		CN	
Date	**OE cat.**	**Comments**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**
14-Sep-16	good	Water level below normal, visibility okay.	14		265	1			109	2	150	
30-Sep-16	excellent	Water level below normal, good visibility	27		115	1			978	4	146	7
18-Nov-16*	excellent	Water level normal, good visibility			323	1						
		Raw PL+D	27		324		0		982		153	
		Exp PL+D	30		360		0		1,091		187	

*Upper Toquaht survey from above the 2nd bridge to Toquaht Lake, coho-directed survey.

Table 11-2. Escapement estimates based on survey results. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Species	**Annual escapement estimate**	**Analytical method**	**Data quality level**
Sockeye	30	PL+D	3
Coho	360	PL+D	2
Pink	None Observed	PL+D	3
Chum	1,091	PL+D	3
Chinook	168	PL+D	2

Escapement Commentary:

SK return:	-
CO return:	Was close to the peak for Upper Toquaht, weren't big individuals (different than other systems) is a Summer run, didn't see fungus this year (saw a lot last year), temps were lower.
PK return:	
CM return:	Survey of the Lower Toquaht was too early to catch the chum peak based on observed run timing in Nahmint and Sarita.
CN return:	Probably close to the peak for CN

11.3. Spawner Distribution

Run Timing:

Table 11-3. The run timing for the survey year by species.

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye					Late Oct		
Coho						Late Nov	
Pink							
Chum					Mid Oct	Late Oct	Early Nov
Chinook					Mid Oct	Mid Oct (2-3rd week)	Early Nov

Comments: Has a summer run of coho, due to the lake.

Spatial Distribution:

Table 11-4. The survey sections used by spawners per species. Similar to last year

Species	Survey Section(s) used for spawning
Sockeye	
Coho	well spread out through the upper river
Pink	
Chum	
Chinook	spread out in the lower river, not seen in the upper river this year
Steelhead	

11.4. Environmental Conditions

Poor survey coverage in October and first half of November due to high waters and dangerous swimming conditions, lots of rain this year

Four log jams in the first km above the lake, keep collecting debris and causing the river to braid. Will affect access to the Upper River (coho primarily affected) contributing to sedimentation.

Hydromet is planned, Toquaht FN is interested in doing some work. The logjam at the mouth of the Upper Toquaht may be remediated.

11.5. Update to Stream Survey Protocols

Current Assessment Method:
Snorkel survey from marker 15 (Lake) -0, ~7500m, Upper Toquaht survey is from marker 27-15 (above the 2nd bridge to the lake, ~6000m).

11.6. Enhancement

Brood Removal: 19 chinook

11.7. Biosamples

11.8. Concerns and Comments

The lower river is pretty stable.

12. COUS CREEK

12.1. Stream Summary

Cous Creek flows southwest into Stamp Narrows, Alberni Inlet. The mainstem is about 11 km long. There are falls 1km from the mouth, which is the extent of the chum-directed survey. Chum spawn up to the falls. Chinook and coho pass above the falls when conditions permit. The Creek was historically a chum stream with occasional observations of coho and chinook.

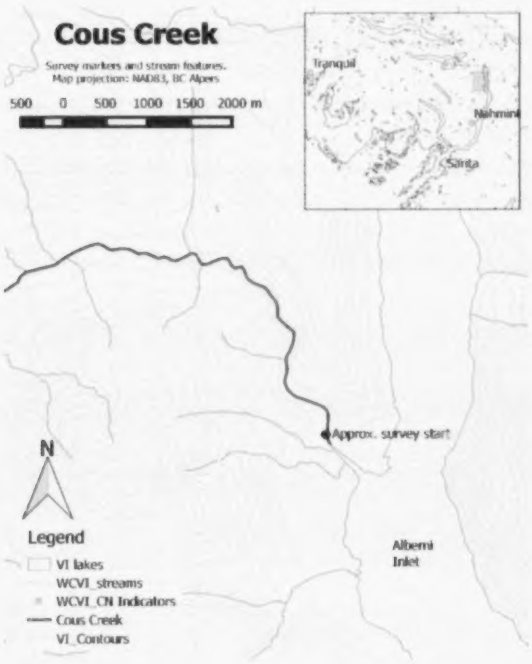

Cous Creek
Survey markers and stream features.
Map projection: NAD83, BC Albers
500 0 500 1000 1500 2000 m
Tranquil
Nahmint
Sarita
Approx. survey start
N
Alberni Inlet
Legend
VI lakes
WCVI_streams
WCVI_CN Indicators
Cous Creek
VI_Contours

Figure 12-1. Cous Creek Map. Inset show locations of other systems that are regularly surveyed in the area. Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia.

12.2. Escapement Estimates

Survey Crew: Hupacasath First Nation (Leon Lauder)
Stock Assessment Biologist: Diana McHugh

Table 12-1. Unexpanded live and dead counts by species for each survey.

Date	**SK**		**CO**		**PK**		**CM**		**CN**	
	Live	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**
29-Sep-16										

Comments: Water level normal. Water clarity was good with high visibility. Tseshaht did a survey, no SIL received, didn't see much. Went in ~mid-Oct (Darwin).

12.3. Escapement Comments

Based on the chum return to the Nahmint, the survey occurred prior to the majority of chum entering.

Took boat up creek into canyon, no fish observed. Some schools of fish observed on sounder in the deeper areas in front of the creek. Did not hike up river, mostly looking for chum. No fish present.

13. MACTUSH CREEK

13.1. Stream Summary

Mactush Creek flows east into Sproat Narrows, Alberni Inlet. The mainstem is 8 km in length and there is a cascade about 2.4 km upstream that is barrier to migration. It is primarily a Chum system with some Coho as well.

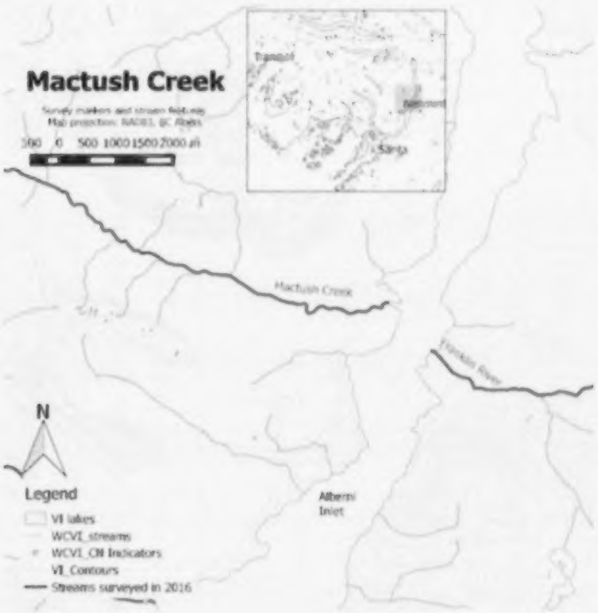

Mactush Creek
Survey markers and stream features
Map projection: NAD83, BC Albers
500 0 500 1000 1500 2000 m
Sarita
Mactush Creek
Franklin River
N
Alberni Inlet
Legend
VI lakes
WCVI_streams
WCVI_CN Indicators
VI_Contours
Streams surveyed in 2016

Figure 13-1. Mactush Creek Map. Inset show locations of other systems that are regularly surveyed in the area. Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia.

13.2. Escapement Estimates

Survey Crew: Hupacasath First Nation (Graham and Cameron Tatoosh)
Stock Assessment Biologist: Diana McHugh

Table 13-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
29-Sep-16	0		0				0			

Comments: Tseshat did an additional survey, no SIL received (Darwin)

13.3. Escapement Comments

Based on the chum return to the Nahmint, the survey occurred prior to the majority of chum entering.

13.4. Environmental Conditions

The river was quite dry, the sounder picked up schools outside and seals were seen, presumably hunting fish.

13.5. Concerns and Comments

The mouth of the river has changed (Darwin).

14. KITSUKSIS CREEK

14.1. Stream Summary

A hatchery and fence are operated on Kitsuksis (a tributary of the Lower Somass), by the Alberni Valley Enhancement Society. They start monitoring at the fence in when the fall rains begin, usually in mid-October. Chum broodstock are first followed by coho . Coho collection continues over the length of the run usually until the end of November.

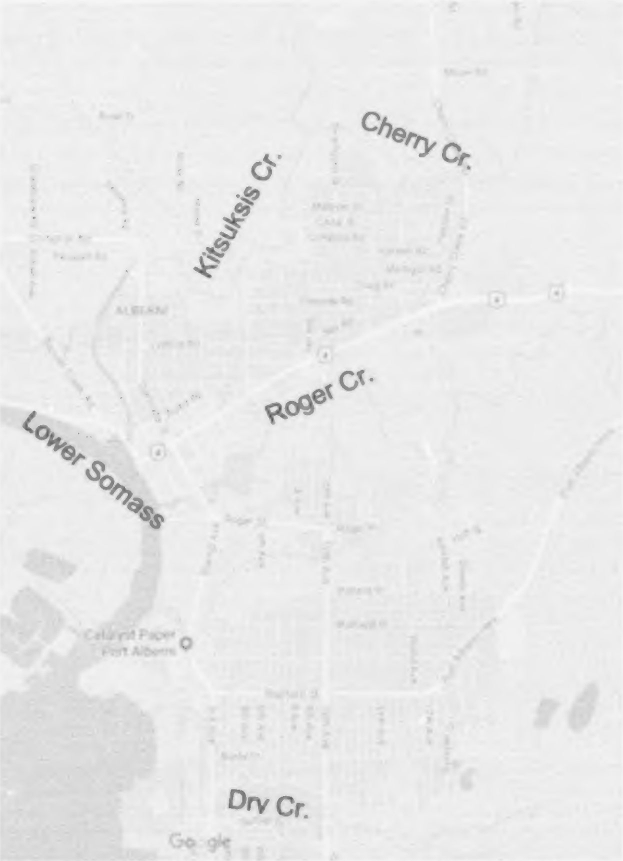


Figure 14-1. Creeks in and around the city of Port Alberni.

14.2. Escapement Estimates

Survey Crew: Scott Kenny
Stock Assessment Biologist: Diana McHugh

14.3. Escapement Comments

Surveyors saw 8 CN, whereas they typically only see coho. An early run this year started early Oct and finished end of Nov. Avg about 600 CO. Coho individuals were large (consistent with other areas). Caught one beaver. There are usually Chum at the bottom. There were significant numbers of Chum in both Kitsuksis and Rogers (didn't see any in Dry Creek). Get Coho in Roger Creek as well.

14.4. Environmental Conditions

14.5. Survey Protocols

Fence: Concrete structure with an aluminum superstructure. Goes in Oct. Also operate a juvenile fence in the spring. Also a smolt trap on Cherry Creek (unenhanced indicator).

14.6. Enhancement/Restoration Activities

Coho brood collection

14.7. Concerns and Comments

Creek realignment in 2013, it used to go through the Mill pond, now it goes around. The old creek is providing good off-channel habitat for coho rearing.

Deer Creek (biosampled by Dan Shannon and Erica Blake) – spot check/dead pitch Chinook one was clipped, 3 does (spawned out, one marked) and 2 bucks.

Effingham: UFN doing some work, plan to do swims this year. Tom Balfour (CWFS) and a UFN member.

STREAMS IN AREA 24

15. AREA 24 SUMMARY OF OBSERVATIONS IN 2016

15.1. Overview

There are almost 60 streams and major tributaries that have records of spawning salmon in Area 24. The priorities for escapement enumeration are the Chinook indicator stocks in the Bedwell River, Tranquil Creek and Megin River. There is no Coho indicator in Area 24. The Moyeha River was historically a Chinook indicator but was dropped due to logistical difficulties. Additional systems are surveyed when funding allows and typically less frequently than the indicator systems. Most surveys are conducted using the snorkel method described in the DFO snorkel survey manual. Occasionally, systems are also surveyed by stream or bank walks. Surveys are typically conducted by DFO contractors, First Nations and local enhancement groups.

Enhancement in Area 24 has been primarily done by the Tofino Salmon Enhancement Society, Thornton Creek Enhancement Society, and Kennedy Lake Hatchery operated by Tla-o-qui-aht. The Kennedy River has been enhanced in most years since the mid-1980s, Tranquil Creek since the early 1990s, Cypre River since the late 1990s and Bedwell River since 2008. Enhancement efforts have focused primarily on Chinook.

15.2. 2016 Operational Summary

In 2016, Surveys early in the season were disrupted by fog, and were disrupted periodically through the season by major rain events, so only a portion of the planned surveys were completed on schedule. The Chum peak was likely missed in most systems, so estimates should be considered uncertain. Based on the available surveys and some ancillary observations, returns of Sockeye, Coho, Chum, and Chinook were good relative to the 12 year average, but Pinks were largely absent this year. However, relative to the provisional Chinook habitat-based escapement targets (S_{msy}), all the surveyed systems fall well-below the target, except for Bedwell and Cypre which are enhanced.

Commentary on #s, spawning extent, holding duration, survey quality, fish condition, brood removal, sex ratio:

- In Megin and Cypre, the size of Coho was particularly large this year. Pink numbers were very low this year. Upper Megin survey was not completed, so the Sockeye peak count is not representative of the population.

Commentary on Habitat: Both Bedwell and Tranquil have changed course this year due to major rain events.

Water levels and temperature were conducive to migration throughout the escapement season. Fog in early September interfered with surveys. Water levels were too high for high quality surveys through much of October due to a series of major storms.

Kennedy Lake: Based on a spot check from the Kennedy River bridge and a boat survey of approximately 500m of the shoreline on Oct 31, large numbers of sockeye are holding in the lake though not yet spawning. "Very good" numbers relative to recent years.

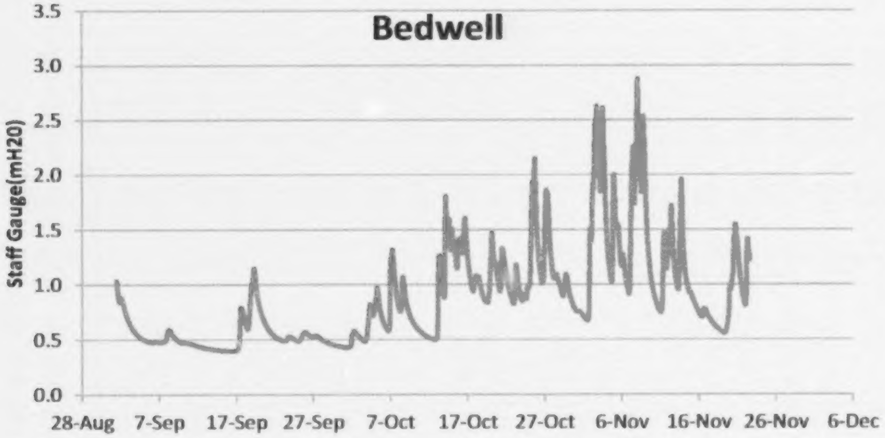


Figure 15-1. Bedwell River conditions Aug 28 – Nov 22; water levels above 0.6 start to reduce survey quality.

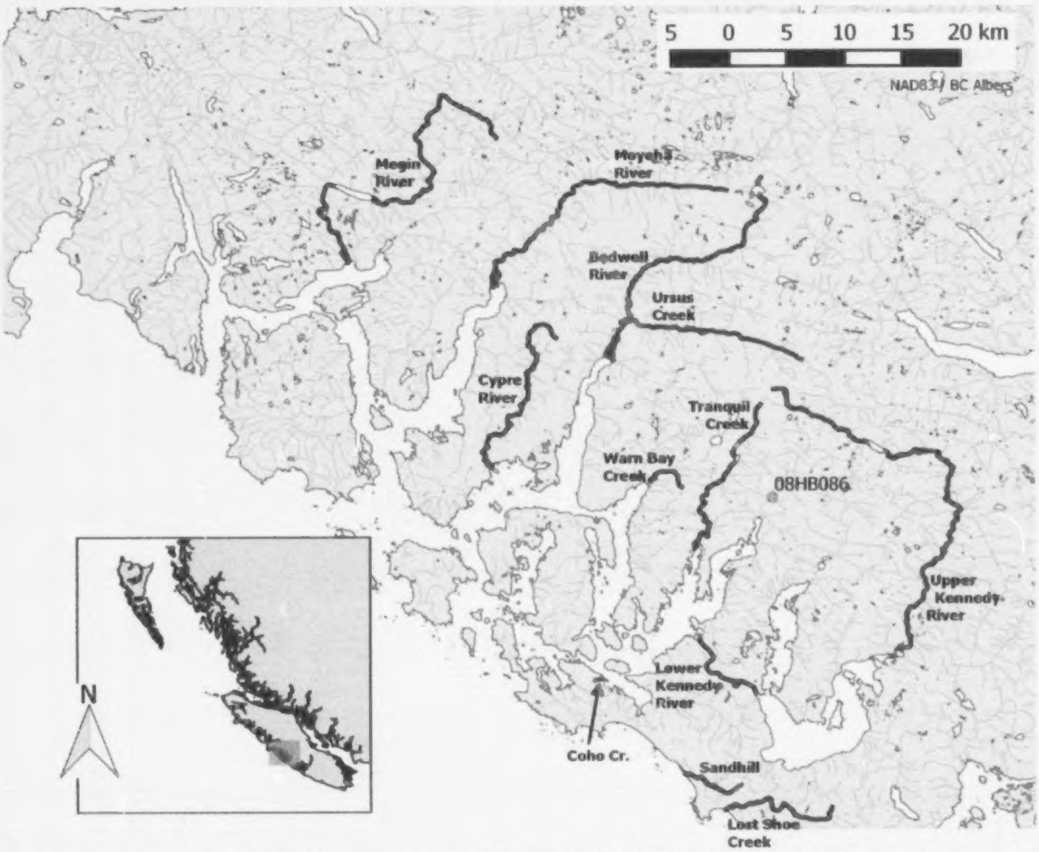

5 0 5 10 15 20 km
NAD83 / BC Albers
Megin River
Moyeha River
Bedwell River
Ursus Creek
Cypre River
Tranquil Creek
Warn Bay Creek
08HB086
Upper Kennedy River
Lower Kennedy River
Coho Cr.
Sandhill
Lost Shoe Creek
N

Figure 15-2. Streams in Area 24 that were surveyed in 2016 (highlighted blue). Streams that were also surveyed but are not shown include Sydney Inlet, Ice River, Isaak and Tsa-Ya. The Environment Canada Hydromet station on Tofino Creek (08HB086) is a good indicator of flow in most systems in the area.

Table 15-1. Escapement: Raw Peak Live + Dead Adult counts by statweek and Preliminary Escapement Estimates, font indicates the level of spawning observed. Underline: 1-9% spawning, Italics: 10-49% spawning, Bold: >50% spawning.

Colour codes for escapement method and plan	
Bank Walk	Helicopter
Stream Walk	Fence
Snorkel	Missed
Boat	Revised plan

Colour codes for esc. Est. compared to the 12 year avg.
> 125%
75%-125%
50%-75%
25%-50%
<25%

System	Species	9-1 Aug 28-Sep 3	9-2 Sept 4-10	9-3 Sept 11-17	9-4 Sept 18-24	10-1 Sept 25-Oct 1	10-2 Oct 2-8	10-3 Oct 9-15	10-4 Oct 16-22	10-5 Oct 23-29	11-1 Oct 30-Nov 5	11-2 Nov 6-12	11-3 Nov 13-19	Esc Est
MOYEHA RIVER	Sockeye			221		194								250
TRANQUIL CREEK	Sockeye		209		194		220				**44**	**7**	**6**	275
BEDWELL RIVER	Sockeye		222			*181*		*175*			**150**		**39**	399
CYPRE RIVER	Sockeye			13	18						**4**		**0**	24
MEGIN RIVER	Sockeye			1		0								2
KENNEDY RIVER (UPPER)	Sockeye		2493											2,500
WARN BAY CREEK	Sockeye								**0**	**0**			**0**	

System	Species	9-1 Aug 28-Sep 3	9-2 Sept 4-10	9-3 Sept 11-17	9-4 Sept 18-24	10-1 Sept 25-Oct 1	10-2 Oct 2-8	10-3 Oct 9-15	10-4 Oct 16-22	10-5 Oct 23-29	11-1 Oct 30-Nov 5	11-2 Nov 6-12	11-3 Nov 13-19	Esc Est
MOYEHA RIVER	Coho			157		1232								1500
TRANQUIL CREEK	Coho		25		148		382				791	*485*	761	1,153
BEDWELL RIVER	Coho		336			1449		1111			694		*518*	2,080
CYPRE RIVER	Coho			96	428						1231		1003	1,780
MEGIN RIVER	Coho			215		162								269
KENNEDY RIVER (UPPER)	Coho		0											
WARN BAY CREEK	Coho								34	30			*16*	40

System	Species	9-1 Aug 28-Sep 3	9-2 Sept 4-10	9-3 Sept 11-17	9-4 Sept 18-24	10-1 Sept 25-Oct 1	10-2 Oct 2-8	10-3 Oct 9-15	10-4 Oct 16-22	10-5 Oct 23-29	11-1 Oct 30-Nov 5	11-2 Nov 6-12	11-3 Nov 13-19	Esc Est
MOYEHA RIVER	Chum			18		930								1000
TRANQUIL CREEK	Chum		50		906		**1366**				**1096**	**49**	**5**	4,505
BEDWELL RIVER	Chum		8			111		*1051*			**3905**		**734**	6,071
CYPRE RIVER	Chum			4	16						**3341**		**153**	4,176
MEGIN RIVER	Chum			26		345								383
KENNEDY RIVER (UPPER)	Chum		0											
WARN BAY CREEK	Chum								**2047**	**2557**			**281**	3,000

System	Species	9-1 Aug 28-Sep 3	9-2 Sept 4-10	9-3 Sept 11-17	9-4 Sept 18-24	10-1 Sept 25-Oct 1	10-2 Oct 2-8	10-3 Oct 9-15	10-4 Oct 16-22	10-5 Oct 23-29	11-1 Oct 30-Nov 5	11-2 Nov 6-12	11-3 Nov 13-19	Esc Est
MOYEHA RIVER	Chinook			50		125								140
TRANQUIL CREEK	Chinook		23		110		157				76	**4**	**0**	310
BEDWELL RIVER	Chinook		53			280		*382*			**95**		**4**	652
CYPRE RIVER	Chinook			220	961						*96*		**0**	1,275
MEGIN RIVER	Chinook			14		10								17
KENNEDY RIVER (UPPER)	Chinook		1											
WARN BAY CREEK	Chinook								**17**	**15**			**1**	25

Table 15-2. Area 24 escapement survey plan matrix for 2016.

Planned Surveys/Activites

- ░ AFS - Ditidaht
- ░ AFS - Tseshaht
- ░ AFS - Hupacasath
- ░ Huu-ay-aht
- ░ DFO Contract
- ▨ External non-DFO (NTC, Maa-nulth, etc.)
- ☐ External DFO/BC (SEP, MOF)

paler shade=cancelled
paler shade+cross hatch=rescheduled, but completed
▨ survey completed data received

Stat Area	First Nation Territory	Stream Name	September				October					November					December		Comments	# Planned	# Done
			9-1	9-2	9-3	9-4	10-1	10-2	10-3	10-4	10-5	11-1	11-2	11-3	11-4	11-5	12-1	12-2	Survey Type and Target		
24	Tla-o-qui-aht	ANGORA CREEK										░							PL+D: Chinook/coho/chum	1	
24	Ahousaht	ATLEO RIVER					░												PL+D: Chinook/coho/chum	1	
24	Ahousaht	BAWDEN CREEK					░												walk Bawden Bay	1	
24	Ahousaht	BEDINGFIELD BAY CREEK																			
24	Ahousaht	BEDWELL SYSTEM	snkl	▨ snkl	snkl	snkl	▨ snkl	snkl	▨	snkl		▨		▨			▨		AUC: Chinook, chum, coho; Brood	7	6
24	Ahousaht	BULSON CREEK																			
24	Ahousaht	CECILIA CREEK																			
24	Tla-o-qui-aht	CLAYOQUOT ARM BEACHES																			
24	Tla-o-qui-aht	CLAYOQUOT RIVER																			
24	Tla-o-qui-aht	CLAYOQUOT RIVER (LOWER)																			
24	Tla-o-qui-aht	CLAYOQUOT RIVER (UPPER)																			
24		CLOSE CREEKS (2)																			
24		COHO CREEK									▨		▨	▨	▨	▨	▨	▨	Central Westcoast Forest Society		7
24	Tla-o-qui-aht	COLD CREEK																			
24	Tla-o-qui-aht	CONE CREEKS (2)									▨	▨									2
24	Ahousaht	COTTER CREEK																			
24	Ahousaht	COW CREEK																			
24	Ahousaht	CYPRE RIVER		snkl	▨	▨ snkl	snkl		snkl			▨							PL+D: Chinook/coho/chum; Brood	4	3
24		English Cove Creek														▨	▨	▨			3
24	Tla-o-qui-aht	FUNDY CREEK										▨									1
24	Hesquiaht	HESQUIAT HARBOUR #1 CREEKS																			
24	Hesquiaht	HESQUIAT HARBOUR #2 CREEKS (Ayyi Saqh)				░		░											PL+D: coho/chum	2	
24	Hesquiaht	HESQUIAT HARBOUR #3 CREEKS (Yaaksis)			░	░		░	░										PL+D: coho/chum	4	
24	Hesquiaht	HESQUIAT HARBOUR #4 CREEKS (Ma-api)							░	░									PL+D: coho/chum	2	
24	Hesquiaht	HESQUIAT LAKE CREEK (Tsa-ya)		░	░	░	░	░	░	░	░								PL+D: coho/chum	8	
24	Hesquiaht/Ahousaht	HESQUIAT POINT CREEK																			
24	Ahousaht	HOOTLA KOOTLA CREEK					░												PL+D: Chinook/coho/chum	1	
24	Hesquiaht	HOT SPRINGS COVE CREEK (Ahtaapq and side channel)								░									PL+D: coho/chum	1	1
24	Ahousaht	ICE RIVER					░												PL+D: Chinook/coho/chum	1	
24	Tla-o-qui-aht	KENNEDY LAKE FEEDER STREAMS																	Muriel Staghorn		
24	Tla-o-qui-aht	KENNEDY RIVER																			
24	Tla-o-qui-aht	KENNEDY RIVER (LOWER)																	Chinook		
24	Tla-o-qui-aht	KENNEDY LAKE BEACHES																		0	
24	Tla-o-qui-aht	KENNEDY RIVER (UPPER)		▨												▨		▨	Sockeye, coho, TCES paid by SEP		3
24	Tla-o-qui-aht	KOOTOWIS CREEK																	spot checks, low visibility		
24	Ahousaht	LITTLE WHITEPINE COVE #1 CREEK																			
24	Yuutu?it?ath (Ucluelet)	LOST SHOE CREEK									▨		▨	▨	▨	▨	▨	▨	Central Westcoast Forest Society		7
24		Meares Creek									▨	▨									2
24	Ahousaht	MEGIN RIVER	snkl		▨ snkl	snkl	▨ snkl	snkl	snkl		snkl								AUC: Chinook, chum, coho, Upper Megin (NTC): Coho, Sockeye	7	2
24	Ahousaht	MOYEHA RIVER	snkl	snkl	▨ snkl	snkl	▨ snkl			░				░	░				Early Chinook system	7	2
24	Hesquiaht	PACILTH CREEK				░	░		░	░									PL+D: chum	4	
24	Hesquiaht	PURDON CREEK				░													coho	1	
24	Ahousaht	RILEY CREEK					░												PL+D: Chinook/coho/chum	1	
24	Tla-o-qui-aht	SAND RIVER																			
24	Yuutu?it?ath (Ucluelet)	SANDHILL CREEK									▨		▨	▨	▨	▨	▨		Central Westcoast Forest Society		6

24	Tla-o-qui-aht	SUTTON MILL CREEK										▤									1
24	Ahousaht	SYDNEY RIVER																			
24	Tla-o-qui-aht	TOFINO CREEK																			
24	Tla-o-qui-aht	TRANQUIL CREEK	snkl	▤	snkl	▤	snkl	▤		snkl		▤	▤	▤		▤			AUC: Chinook, chum, coho	6	7
24	Ahousaht	WARN BAY CREEK								▤	▤			▤							3
24	Ahousaht	WATTA CREEK																			
24	Ahousaht	WHITE PINE COVE CREEK					░												PL+D: Chinook/ coho/chum	1	

15.3. Escapement survey review meeting

The 2016 survey results from Area 24 were reviewed at a post-season escapement review workshop held at the Tofino Botanical Gardens in Tofino on February 8, 2017. Workshops participants (Table 15-3) reviewed and discussed the individual survey results and escapement estimates, then collaboratively filled in the commentary for each system that was surveyed. Participants also discussed quality of the observations and classified the estimates according to how they can be used for management purposes. Most of the commentary in the first section of each stream summary was derived from the stream narratives which have been completed by numerous surveyors over the past 20 years.

General trends discussed for Area 24 in 2016 included:

- Large Coho across the area (except in Coho Creek where Coho are usually small)
- Good Chum return

Additional issues discussed included:

- Hequiaht Harbour is closed to fishing. A lot of seals eating adults and sawbills (80-100 mergansers) eating the juveniles.
- Additional habitat information in Hesquiat Harbour office. A lot of the streams need restoration work. Streams piling up (Ma-pi, Yaksis Tsa-ya), deactivated roads, are coming down into the streams. 6-7 feet high gravel bars where there used to be pools.
- Megin: Ahousaht Fisheries, in May and June, saw a lot of SK at the mouth of the Megin, a lot of CO and CM, warm water. Caught marble CN at the reserve (white/red flesh), might be strays.
- To get biosamples, may need to have someone stationed in Ahousaht to collect biosamples as fishery timing in variable (train someone there or have the creel surveyors assist). Ahousaht Fisheries department is a busy three man crew.
- A. Jackson comments: run timing seems to be getting later every year, hopefully with the snow pack the water this upcoming season will be cool enough for salmon to come in more normal-timed (earlier). The mountains have greened up, which has helped with the sedimentation. Hopefully the water will be cool enough for the May run SK to come in. Where do the May run SK go? Maybe Clayoquot Lake or Clayoquot River.
- It would be good to coordinate data logger information into a monitoring database.

Table 15-3. Participants at the Area 24 escapement review workshop in Tofino on February 8, 2017.

Participant	Affiliation
Erica Blake	DFO, Community advisor
Rufus Charleson	Hesquiaht First Nation
Jared Dick	NTC biologist
Emily Grubb	Central Westcoast Forest Society
Dave Hurwitz	Thorton Creek Enhancement Society
Jessica Hutchinson	Central Westcoast Forest Society
Andrew Jackson	Tla-o-qui-aht First Nation (Kennedy Lake Hatchery)
Stephanie King	Sea This Consulting (organizer)
Diana McHugh	DFO (organizer)
Doug Palfrey	Tofino Enhancement Society
Candace Picco	NTC biologist
Larry Swan	Ahousaht First Nation
Pat Vek	DFO

Figure 15-3. Participants of the Area 24 escapement review workshop, February 8, 2017.

16. BEDWELL RIVER/URSUS CREEK

16.1. Stream Summary

The Bedwell River and Ursus Creek (Figure 16-1) make up the Bedwell System, which flows southwest into the Bedwell Sound. The area is remote with the exception of the Clayoquot Wilderness Resort which operates at the mouth of the River. The Bedwell River is fed by glacier snowmelt from many steep tributaries and by Bedwell Lake located almost 30 km upstream from the mouth.

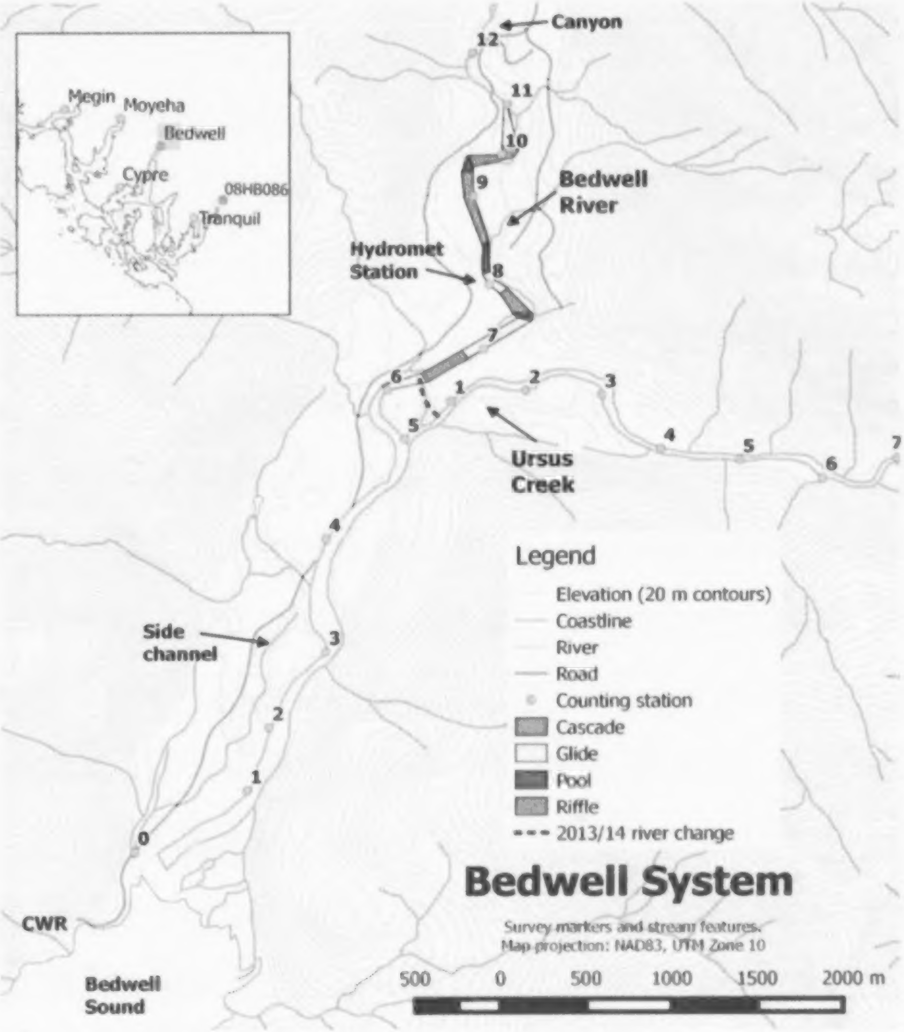

Canyon
12
11
10
9
Bedwell River
Hydromet Station
8
7
6
5
1
2
3
4
5
6
7
Ursus Creek
4
Side channel
3
2
1
0
CWR
Bedwell Sound
Megin
Moyeha
Bedwell
Cypre
08HB086
Tranquil
Legend
Elevation (20 m contours)
Coastline
River
Road
Counting station
Cascade
Glide
Pool
Riffle
2013/14 river change
Bedwell System
Survey markers and stream features.
Map projection: NAD83, UTM Zone 10
500
0
500
1000
1500
2000 m

Figure 16-1. The Bedwell/Ursus system habitat units and counting stations. Map inset shows locations of other systems that are regularly surveyed in Area 24 as well as the location of the Environment Canada hydromet station at Tofino Creek (08HB086). Roads, rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. The 2013/14 river change (purple dashed line) shows the approximate location of the Ursus channel as of 2014. This channel changed in 2016 to join up at marker 5. Habitat data were mapped in the field and / or digitized from recent high resolution orthophotographs by M.C. Wright and Associates Ltd.

The lower 6 km of the Bedwell River has been divided into 12-500 m survey sections for salmon enumeration. At the top of the survey section on the Bedwell River there is a canyon that is impassible to fish. The largest tributary to the Bedwell is Ursus Creek which historically entered the Bedwell River at survey marker 5. In the past several years there have been major changes in the stream channel around the confluence with the Ursus. The location of marker 6 in Figure 16-1 is now dry river bed. The channel cut in 2013/14 is also now dry, and the in 2016, a new channel formed that goes from the bottom of the riffle above marker 6 straight to marker 5. The lower 3 km, markers 0 to 6, is the area usually surveyed on the Ursus.

The system is dynamic, with few or no log jams and no beaver dams. The mainstem channels are generally shallow and wide, and erosion is a problem. Most large woody debris gets washed out. On a high tide, salt water reaches marker 1. There are several deep pools on the Bedwell between markers 2 and 3, 9 and 10 and below the canyon (marker 12) on the Bedwell. The pool between markers 4 and 5 has been filling-in in recent years and is now only 3-4 feet deep. On Ursus Creek, there are several pools between markers 3 and 6.

The system is described as 'great indicator stream' with generally clear water and pools that have excellent visibility. After heavy rainfall the system will become murky and take up to three days to clear. The water clarity and retainment characteristics are similar to nearby systems Cypre, Tranquil and Moyeha. Typical flow for the Bedwell system is 1.8 m^3/s, compared to 0.4 for Tranquil and 0.8 for Megin. The Bedwell is considered a relatively cool system, with temperatures slightly cooler than Tranquil. The Environment Canada Water Survey Station at Tofino Creek (08HB086) has a long record of discharge measurements and can be used as an indicator for discharge at Bedwell. DFO installed a hydromet station on the Bedwell in 2015 at marker 8. Seals are occasionally seen in the estuary but also not considered to be a problem.

Historical spawner survey reports note considerable silt and erosion. The upper reaches of the Ursus, above marker 13, are unlogged, relatively flat, but have experienced a lot of change since the early 2000s. There was a side channel installed in the lower river.

16.2. Survey Results and Escapement Estimate

Survey Crew: TCES (D. Palfrey)
Stock Assessment Biologist: D. McHugh

Table 16-1. Unexpanded live and dead counts by species for each survey, peak live plus dead (PL+D) raw and expanded for OE. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:
For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%; For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

Bedwell Creek

			SK		CO		PK		CM		CN	
Date	**OE cat.**	**Comments**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**
10-Sep	Excellent	Staff gauge 0.48m. Horizontal vis 8m, vertical vis 8m. Water level normal.	44		74		1		4		33	
25-Sep	Excellent	Staff gauge 0.53m. Horizontal vis 8m, vertical vis 7m. Water level normal	63		548				92		198	
10-Oct	Good	Staff gauge 0.63m. Horizontal vis 7m, vertical vis 7m. Water level above normal	27		447				970		197	
31-Oct	Fair	Staff gauge 0.77m. Horizontal vis 7m, vertical vis 7m. Water level above normal	5		316				2812	851	14	4
16-Nov	Good	Staff gauge 0.72m. Horizontal vis 6m, vertical vis 5m. Water level above normal	1		279				189	521		
05-Dec	Excellent	Staff gauge 0.57m. Horizontal vis 7m, vertical vis 7m. Water level normal			335	2			14			
		Raw PL+D	63		548		1		3,663		198	
		Exp PL+D	70		609		1		4,579		246	

Ursus Creek (See Bedwell table above for OE category)

			SK		CO		PK		CM		CN	
Date	**OE cat.**	**Comments**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**
10-Sep			178		262				4		20	
25-Sep			118		899	2	1		19		82	
10-Oct			147	1	663	1			81	1	185	1
31-Oct			142	3	378				214	28	71	6
16-Nov			38		291				20	5	3	1
05-Dec			16	1	204				8			
		Raw PL+D	178		901		1		242		186	
		Exp PL+D	223		1001		1		302		232	

Table 16-2. Survey life and range applied for each species. Also includes the first and last zero used for the annual estimate if AUC was the estimate method used.

Bedwell River				
Species	**Survey Life**	**First Zero**	**Last Zero**	**Comments**
Sockeye	30 (25-35)	1-Sep-16	18-Nov-16	
Coho	35 (30-40)	1-Sep-16	15-Dec-16	
Pink	Adults Present			
Chum	15 (10-20)	1-Sep-16	10-Dec-16	
Chinook	25 (20-30)	1-Sep-16	15-Nov-16	CN probably peaked after Oct 10th
Ursus Creek				
Species	**Survey Life**	**First Zero**	**Last Zero**	**Comments**
Sockeye	35 (30-40)	1-Sep-16	30-Nov-16	
Coho	35(30-40)	1-Sep-16	01-Dec-16	
Pink				
Chum	15 (10-20)	01-Sep-16	10-Dec-16	
Chinook	25 (20-30)	01-Sep-16	20-Nov-16	

Table 16-3. Escapement Estimates using the OE and SL parameters described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Species	**Annual escapement estimate (Bedwell)**	**Annual escapement estimate (Ursus)**	**Annual escapement estimate (Bedwell+Ursus)**	**Analytical method**	**Data quality level**
Sockeye	80 (69-96)	354 (310-413)	434		2
Coho	1,058 (925-1,234)	1,423 (1,245-1,660)	2481		2
Pink	Adults Present	Adults Present			
Chum	5,951 (4,463-8,927)	496 (372-743)	6447		2
Chinook	336 (280-420)	314 (262-393)	650		2

Escapement Commentary:

SK return:	Similar to the 12 year average (~400)
CO return:	Above the 12 year average (~1,200)
PK return:	Low relative to the 12 year average (~40)
CM return:	Above the 12 year average (~3,200), side channel has made a big difference to chum returns, missed the peak observation
CN return:	Above the 12 year average (~200)

16.3. Spawner Distribution

Run Timing:

Table 16-4. The run timing for the survey year by species.

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye					Mid Oct	Late Oct	
Coho					Mid Nov		
Pink							
Chum					Mid Oct	Late Oct	Mid Nov
Chinook					Mid Oct		Late Oct

Spatial Distribution:

Table 16-5. The survey sections used by spawners per species.

Species	Survey Section(s) used for spawning
Sockeye	Bedwell: 12-10; Ursus: 5-0
Coho	Bedwell: 12-9, 5-4, 2-1 Ursus: 6-0
Pink	No spawning observed in the Bedwell system in 2016
Chum	Bedwell: 5-2, about half were in the side channel between markers 4 and 3 on river right (~1km above tidal) Ursus: 5-0
Chinook	Bedwell:12-9 5-4 Ursus: 6-1
Steelhead	

16.4. Environmental Conditions

Weather Summary:	Weather interfered with the schedule
Physical Characteristics Update:	Confluence moved again; Marker 6 is now dry; side channel blew through around marker 6. Section 8-7: 500 m of erosion on river right in area of alders. Poor logging practices with no streamside planting. 200m of erosion on river left just above the confluence. Poor logging practices with no replanting. Confluence is now 200m up the Ursus. Original pool now filled in with boulders. There have been more changes here in the last 3 years than the previous 30.

16.5. Update to Stream Survey Protocols

Current Assessment Method:	Snorkel surveys, two crews. Bedwell: 12 to 0, Ursus: 100m above 6 to 0 (Cascades to confluence). Side channel included in Bedwell section. No deviations from protocols.
Deviations from current assessment protocols:	None, boat to Bedwell, then vehicle to top of Bedwell. Drive and 3 km walk up to top of Ursus. Swim down to boat. Boat back to Tofino.
Access Updates:	
Safety Update:	None. Cell phones don't work, need sat phone, the Outpost monitors Channel 10 on VHF

16.6. Enhancement

Brood Removal:
Chinook: 8

16.7. Biosamples

Out of 24 biosamples, 12 were clipped. 13 were female, 11 were male.

16.8. Concerns and Comments

17. MEGIN RIVER

17.1. Stream Summary

The lower Megin River flows out of the western end of Megin Lake and southward into Shelter Inlet in Clayoquot Sound (Figure 17-1). The system is remote and access is only available via boat or plane. Fog is often a problem for accessing the system. The Megin is located in Strathcona Provincial Park and near the mouth is the Megin River Ecological Reserved which was established in 1981. The area is unlogged with pristine habitat in the park. As of the early 2000s there have been no survey markers on this system. Survey sections are estimated using habitat and reference to survey markers is based on historical positions of 19 survey markers, each about 500 m apart.

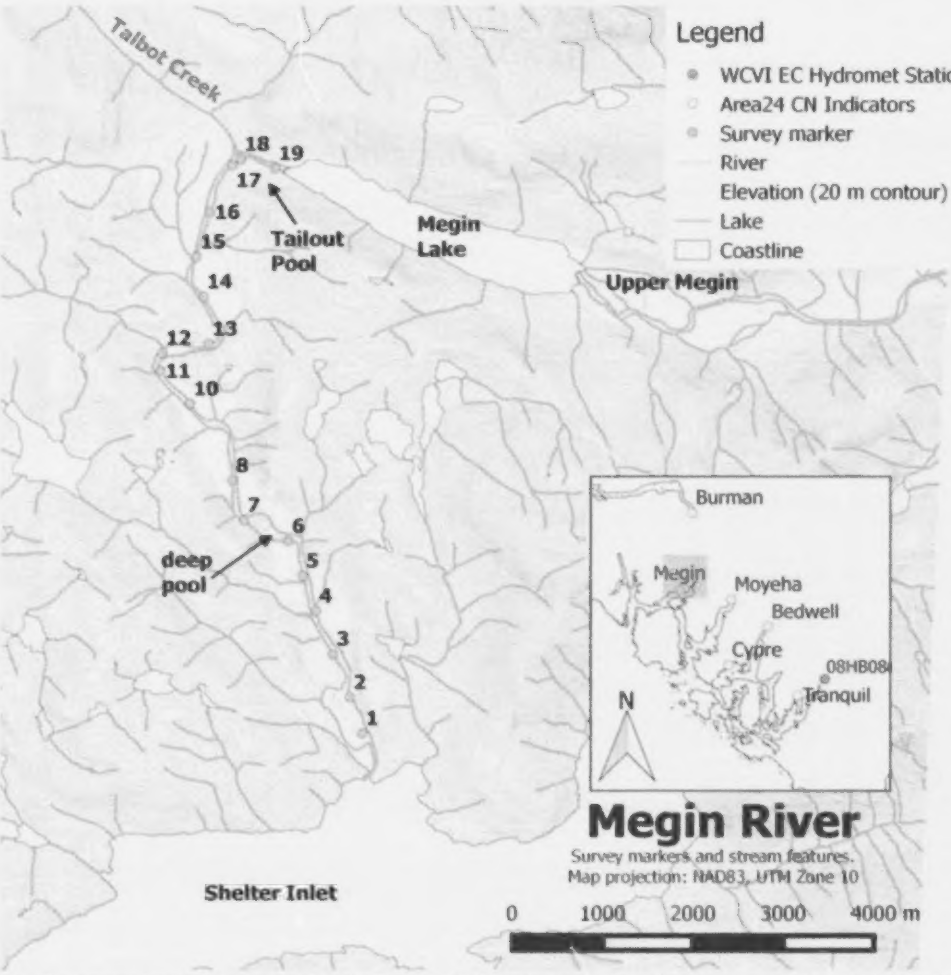

Talbot Creek
18
19
17
16
15
Tailout Pool
Megin Lake
14
13
12
11
10
8
7
6
deep pool
5
4
3
2
1
Upper Megin
Shelter Inlet
Legend
WCVI EC Hydromet Stations
Area24 CN Indicators
Survey marker
River
Elevation (20 m contour)
Lake
Coastline
Burman
Megin
Moyeha
Bedwell
Cypre
08HB08
Tranquil
N
Megin River
Survey markers and stream features.
Map projection: NAD83, UTM Zone 10
0
1000
2000
3000
4000 m

Figure 17-1. The approximate location of Megin River counting stations. Roads, rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. Reference to survey markers are based on historical positions and should be updated if new markers are installed. Map inset shows locations of other well-sampled systems in the area and also the location of the Environment Canada monitoring station at Tofino Creek (08HB086).

The lower Megin River is fed by Megin Lake, located about 9.5 km upstream from the mouth, as well as many small tributaries. The largest tributary is Talbot Creek which joins the lower Megin about 9 km upstream from the mouth (near marker 18). Megin Lake is fed by the upper Megin River and many small tributaries. The lower Megin has water clarity and retainment characteristics that are quite different from other streams in Area 24. The system has heavy suspended silt after rains and can take up to 6 days to clear. Some pools never clear. The Upper Megin, above the lake, is clearer and takes less time to clear after rain.

The Megin River is described as a slow system with many areas of little or no water movement. Typical flow for the Megin is 0.8 m^3/s compared to 1.8 m^3/s for the Bedwell River and 0.4 m^3/s for Tranquil Creek. The lower Megin has a low gradient (<2%) and mostly consists of wide cobble/gravel bars. There are several deep pools, including the Tailout Pool (marker 18), a deep pool near marker 7 (~10 m depth), and another pool near marker 3. The habitat is generally described as stable. However, in 2014, erosion was noted near marker 1.

17.2. Survey Results and Escapement Estimate

Survey Crew: TCES (D. Palfrey)
Stock Assessment Biologist: D. McHugh

Only 2 surveys were conducted, peak spawning wasn't observed for any species

Table 17-1. Unexpanded live (L) and dead (D) counts by species for each survey, peak live plus dead (PL+D) raw and expanded for OE. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:
For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%; For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

Date	**OE cat.**	**Comments**	**SK**		**CO**		**PK**		**CM**		**CN**	
			L	**D**	**L**	**D**	**L**	**D**	**L**	**D**	**L**	**D**
13-Sep	Good	Horizontal vis 5m, vertical vis 4m. No staff gauge	1		215				26		14	
27-Sep	Good	Horizontal vis 5m, vertical vis 4m. No staff gauge			162				342	3	10	
		Raw PL+D	1		215		0		345		14	
		Exp PL+D	1		269		0		383		17	

Table 17-2. Survey life (SL), adult escapement estimate and rational how the method was applied. Escapement estimates use the OE described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Sp.	**SL**	**First Zero**	**Last Zero**	**Comments**	**Annual escapement estimate**	**Analytical method**	**Data quality level**
SK					Adults Present		
CO					268	PL+D	3
PK							
CM					383	PL+D	3
CN					17	PL+D	3

Escapement Commentary:

SK return:

CO return: Moderate return based on the average run timing.

PK return:

CM return:

CN return: Low numbers, given the timing, a significant portion of the total should have been present during the available surveys.

17.3. Spawner Distribution

Run Timing:

Table 17-3. The run timing for the survey year by species.

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye							
Coho							
Pink							
Chum					Late Sept		
Chinook					Late Sept		

Comments: Only two surveys conducted, both in September. Peak spawning missed for all species

Spatial Distribution:

Table 17-4. The survey sections used by spawners per species.

Species	Survey Section(s) used for spawning
Sockeye	
Coho	
Pink	
Chum	10-0
Chinook	19-18, 13-12
Steelhead	

17.4. Environmental Conditions

Weather Summary: Fog and stormy weather interfered with access, which requires a float plane drop-off and pickup.

Physical Characteristics Update: None

17.5. Update to Stream Survey Protocols

Current Assessment Method:	Snorkel swim from 19 to 0 (Lake to Mouth), float plane drop off and pickup.
Deviations from current assessment protocols:	None. Upper Megin not surveyed, so Coho and Sockeye numbers are not comparable.
Access Updates:	None
Safety Update:	None, use radio channel 16 and 68 for Ahousaht (71a for Ahousaht Search and Rescue).

17.6. Enhancement

Brood Removal:
None.

Planned Release Numbers and Strategy:
None.

Other Activities:
None.

17.7. Biosamples

17.8. Concerns and Comments

- 9/27:Extremely low CN & CM numbers.
- Netting in the river mouth observed by pilot observed 2 weeks prior.

18. TRANQUIL CREEK

18.1. Stream Summary

Tranquil Creek flows south into the head of Tranquil Inlet in Clayoquot Sound. Tranquil is a small, clear system fed mainly by run-off and small surrounding streams. The lower 3.5 km of the system have been divided into seven 500 m sections for salmon enumeration (Figure 18-1). There are falls located about 3.5 km upstream which are considered impassable to fish. The system has several deep (~6 m), clear pools including pool just below the falls, a small pool just below marker 6, the Mossy Rock Pool below marker 5, the Road Pool between markers 3 and 2, and Dougie's Pool at marker 2.

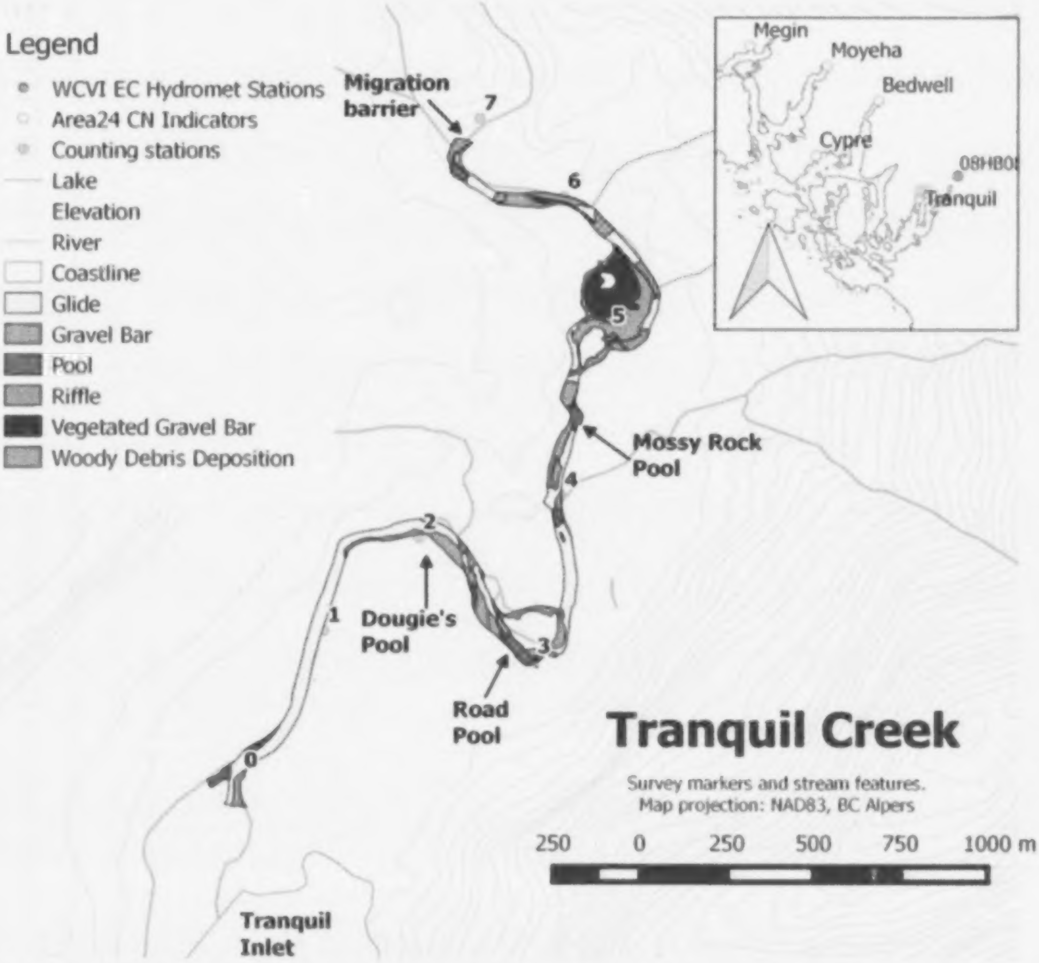

Legend
● WCVI EC Hydromet Stations
○ Area24 CN Indicators
● Counting stations
Lake
Elevation
River
Coastline
Glide
Gravel Bar
Pool
Riffle
Vegetated Gravel Bar
Woody Debris Deposition
Migration barrier
7
6
5
4
3
2
1
0
Mossy Rock Pool
Dougie's Pool
Road Pool
Tranquil Inlet
Megin
Moyeha
Bedwell
Cypre
08HB0
Tranquil
Tranquil Creek
Survey markers and stream features.
Map projection: NAD83, BC Albers
250
0
250
500
750
1000 m

Figure 18-1. Tranquil Creek survey marker locations. Map inset shows locations of other systems that are regularly surveyed in Area 24 as well as the location of the Environment Canada hydromet station at Tofino Creek (08HB086). Roads, rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. Habitat data were mapped in the field and / or digitized from recent high resolution orthophotographs by M.C. Wright and Associates Ltd.

The system is generally clear with good visibility except after heavy rainfall when it becomes murky and takes up to three days to clear. The water clarity and retainment characteristics are similar to Cypre, Bedwell and Moyeha. Typical flow for the Tranquil Creek is 0.4 m^3/s, compared to 1.8 for Bedwell, and 0.8 for Megin. Tranquil is warmer than Bedwell, but temperature is never an issue for spawning salmon or surveys. The closest station where discharge is monitored is at Tofino Creek (Environment Canada Water Survey Station 08HB086) or on the Bedwell River since 2015.

Surveyors report frequent erosion events including large slides in 2006 and 2009 which degraded water quality for several weeks during the fall. In late-2011, there was a major flow event which cut a new channel between markers 3 and 2. The event deposited sand downstream to marker 2 and partially filled in Dougie's Pool. Ongoing erosion is reported above marker 3 where the system is eating away at alders on the bank. There is a small alder log-jam below marker 3. Most of area around the stream has been logged, although near survey maker 6 there are a few very old cedars.

Salmon enhancement started on the Tranquil in 1990 by Tofino Creek Enhancement Society and the Thornton Creek Hatchery. Chinook and Coho Salmon continue to be enhanced.

18.2. Survey Results and Escapement Estimate

Survey Crew: TCES (D. Palfrey)
Stock Assessment Biologist: D. McHugh

Survey Data:

Table 18-1. Unexpanded live (L) and dead (D) counts by species for each survey, peak live plus dead (PL+D) raw and expanded for OE. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:
For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%; For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

			SK		CO		PK		CM		CN	
Date	**OE cat.**	**Comments**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**
06-Sep	Excellent	Staff Gauge 0.61m, Horizontal Vis 8m, Vertical Vis 8m	209		25		1		50		23	
20-Sep	Good	Staff Gauge 0.74m, Horizontal Vis 7m, Vertical Vis 7m	194		148				905	1	110	
03-Oct	Excellent	Staff Gauge 0.58m, Horizontal Vis 8m, Vertical Vis 8m	220		382		2		1352	9	157	
30-Oct	Fair	Staff Gauge 0.81m, Horizontal Vis 7m, Vertical Vis 7m	44		791				967	134	72	4
10-Nov	Fair	Staff Gauge 0.82m, Horizontal Vis 6m, Vertical Vis 5m	7		485				45	4	4	
18-Nov	Good	Staff Gauge 0.66m, Horizontal Vis 8m, Vertical Vis 7m	7		759	2			5			1
27-Nov	Good	Staff Gauge 0.69m, Horizontal Vis 7m, Vertical Vis 7m			454	16						
		Raw PL+D	220		791		2		1,361		157	
		Exp PL+D	244		1,217		2		1,512		174	

Table 18-2. Survey life (SL), adult escapement estimate and rational how the method was applied. Escapement estimates use the OE described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Sp.	**SL**	**First Zero**	**Last Zero**	**Comments**	**Annual escapement estimate**	**Analytical method**	**Data quality level**
SK	40 (35-45)	Sep 1	Nov 15		295 (262-337)	AUC	2
CO	35 (30-40)	Sep 1	Dec 1		1,520 (1,330-1,774)	AUC	2
PK					Adults Present		
CM	15 (10-20)	Sep 1	Nov 20		4,511 (3,384-6,767)	AUC	2
CN	25 (20-30)	Sep 1	Nov 15		310 (258-387)	AUC	3

Escapement Commentary:

SK return: Similar to the 12 year average (~280)

CO return: Above the 12 year average (~800)

PK return:

CM return: Roughly half of the 12 year average (~9,400)

CN return: Similar to the 12 year average (~390), TCES netted on Oct 10 for brood, chinook were mostly green, only went in once for brood. Released ~25 females, ~40% females, good numbers. Bigger females than last year.

18.3. Spawner Distribution

Run Timing:

Table 18-3. The run timing for the survey year by species.

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye						Late Oct	Early Nov
Coho					Mid Nov	Late Nov	
Pink							
Chum					Late Sept	Late Oct	Early Nov
Chinook							late Oct

Comments: No surveys conducted between Oct 3 and Oct 30, Chinook spawning was not observed.

Spatial Distribution:

Table 18-4. The survey sections used by spawners per species.

Species	Survey Section(s) used for spawning
Sockeye	7-6, 4-0
Coho	6-0
Pink	
Chum	7-0
Chinook	7-0
Steelhead	

18.4. Environmental Conditions

Weather Summary:

Physical Characteristics Update: Stream changed in 2012, a bit more erosion river left ~200m below marker 4 on river left.
11/18: Section 4-3 recent erosion on river left 50m long x 2 m wide, pool filled in with rock and gravel. Bridge is out and surveyors now walk in 3 km
11/27: Continued erosion of steep bank 30m. River will form new channel as erosion taking place & working to create another island.

18.5. Update to Stream Survey Protocols

Current Assessment Method:	Snorkel swim from 7-0.
Deviations from current assessment protocols:	None
Access Updates:	Boat then drive to top, bridge over a tributary is still impassible. Could be made passable, BC Timber Sales may be headed in to repair a culvert blocking passage of tributary into Tranquil at Marker 5, but access to the survey section by vehicle is blocked. Crew can get in, but requires walking and may be unsafe. There is a big hole 2km in from the dryland sort. Dock also needs repair.
Safety Update:	Cell works at dock, channel 10 to Creative Salmon, bridge could be hazardous, channel 16 also works.

18.6. Enhancement

Brood Removal:
1 male CN, 1 female CN

Planned Release Numbers and Strategy:
None

Other Enhancement/Restoration Activities:
None

18.7. Biosamples

Description of Biosamples including reason for sample and sample description:
10/30: 4 CN Biosampled

18.8. Concerns and Comments

19. CYPRE RIVER

19.1. Stream Summary

The Cypre River flows south into Cypress Bay, west of Bedwell Sound in Clayoquot Sound. It is a clean, clear fast flowing system fed by many small tributaries from the surrounding mountains. The mainstem length is about 21 km and there are many small tributaries.

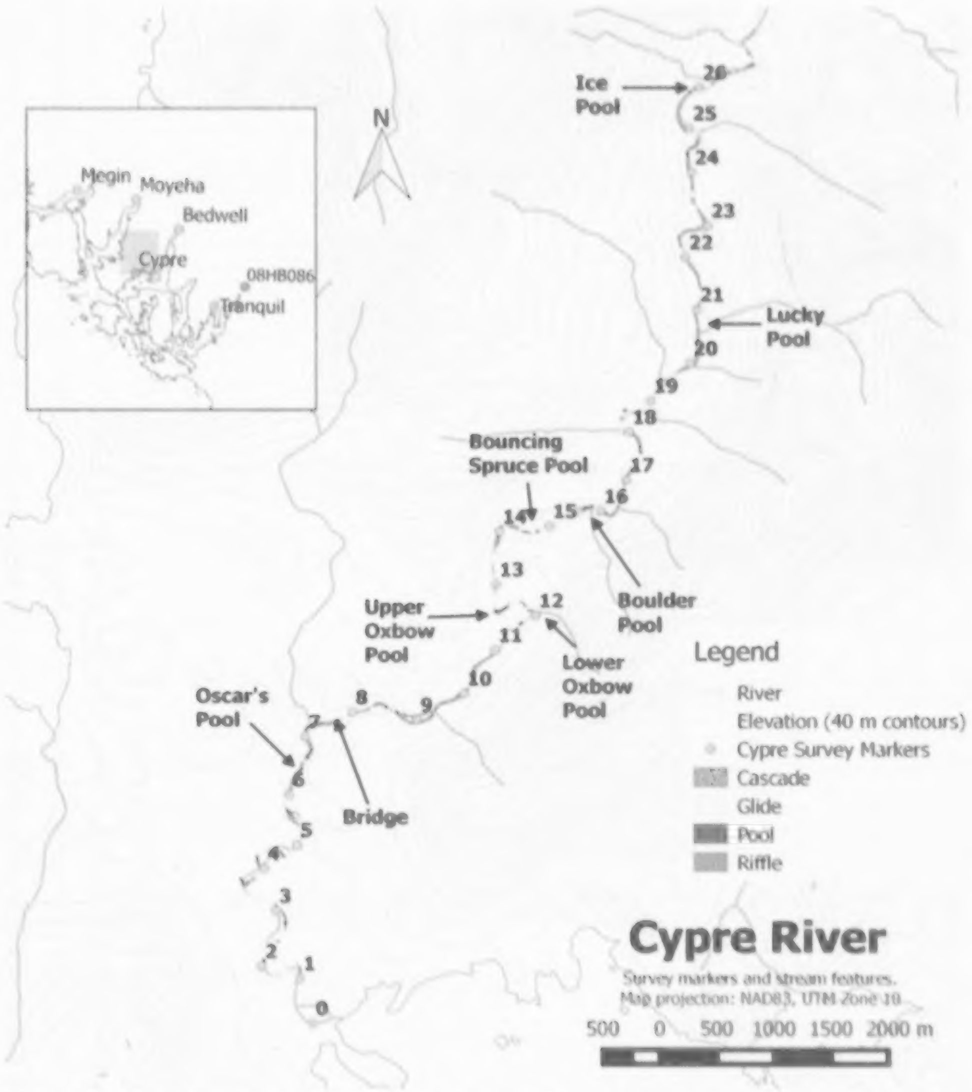

Megin
Moyeha
Bedwell
Cypre
08HB086
Tranquil
N
Ice Pool
26
25
24
23
22
21
Lucky Pool
20
19
18
Bouncing Spruce Pool
17
16
14
15
Boulder Pool
13
Upper Oxbow Pool
12
11
Lower Oxbow Pool
10
Oscar's Pool
8
9
7
Bridge
6
5
4
3
2
1
0
Legend
River
Elevation (40 m contours)
Cypre Survey Markers
Cascade
Glide
Pool
Riffle
Cypre River
Survey markers and stream features.
Map projection: NAD83, UTM Zone 10
500 0 500 1000 1500 2000 m

Figure 19-1. Cypre River counting stations and habitat units. Map inset shows locations of other systems that are regularly surveyed in Area 24 as well as the location of the Environment Canada hydrometric station at Tofino Creek (08HB086). Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. Habitat data were mapped in the field and / or digitized from recent high resolution orthophotographs by M.C. Wright and Associates Ltd. The positions of survey markers 15 to 26 are approximate.

Compared to other streams in the area, Cypre flow is moderate; slightly less than the Moyeha and more than Tranquil. The system has a large floodplain and the lower 4 km has a low gradient (i.e. below marker 8). About 8 km upstream from the mouth (i.e. above marker 16) the stream becomes steeper, has two sets of cascades, more boulders and not as much spawning habitat. There is a canyon between survey markers 8 and 9 which is swimmable under most conditions. There are falls about 13 km upstream from the mouth (marker 26). The closest station where discharge is monitored is at Tofino Creek (Environment Canada Water Survey Station 08HB086). Low water can be a problem for fish entering the system. In 2012, fish were unable to access the system prior to late September because of low water level (the Tofino gauge was below 0.1 m at the time).

The lower 13 km of the system is considered suitable spawning habitat and has been divided into 26 - 500 m sections for salmon enumeration (Figure 19-1). There are many deep pools on the system including Oscar's Pool (between markers 6 to 7; Named for Oscar Hanson who was one of the early surveyors), the Oxbow Pool (above marker 12), Bouncing Spruce Pool (100 m below marker 15) and the Boulder Pool (above marker 15), Lucky Pool (between markers 20 and 21), and Ice Pool (near marker 25). There is a cave in the Ice Pool. There were three side channels made in the late-90s: at survey marker 12, in the tidal area between markers 0 and 1 and near marker 20.

The historical survey reports tell of frequent erosion, silting and landslides. Spawner survey reports also frequently note significant amounts of mobile large woody debris causing large areas of scouring in the spawning riffles. The watershed consists of steep terrain and old growth forests. It was subject to extensive damage from poor logging practices in the 1970s and 80s. Logging mostly stopped in the 1980s and since then the Cypre habitat has returned to a stable state with excellent fish habitat with spawning stocks that have rebuilt.

19.2. Survey Results and Escapement Estimate

Survey Crew: TCES (D. Palfrey)
Stock Assessment Biologist: D. McHugh

Survey Data:

Table 19-1. Unexpanded live (L) and dead (D) counts by species for each survey, peak live plus dead (PL+D) raw and expanded for OE. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories: For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%; For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

			SK		CO		PK		CM		CN	
Date	**OE cat.**	**Comments**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**
12-Sep	Excellent		13		102				4		220	
24-Sep	Excellent		18		428		1		16		961	
01-Nov	Fair		4		1230	1			2032	1309	59	37
18-Nov	Good				1002	1			96	57		
		Raw PL+D	18		1,231		1		3,341		961	
		Exp PL+D	20		1,894		1		4,176		1,068	

Table 19-2. Survey life (SL), adult escapement estimate and rational how the method was applied. Escapement estimates use the OE described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Sp.	**SL**	**First Zero**	**Last Zero**	**Comments**	**Annual escapement estimate**	**Analytical method**	**Data quality level**
SK	30 (25-35)	Sep 1	Nov 15		25 (24-33)		3
CO	40 (35-45)	Sep 1	Dec 1		2100 (1867-2401)	AUC	2
PK					Adults Present		
CM	15 (10-20)	Sep 1	Nov 20		4757 (3568-7136)		3
CN	25 (20-30)	Sep 1	Nov 15		1275 (1062-1593)	Missed the peak	3

Escapement Commentary:

SK return:	Below the 12 year average (~36)
CO return:	Above the 12 year average (~1,200), peak is later, average size of individuals was larger than average
PK return:	Few observed which has often been the case in recent years.
CM return:	Above the 12 year average (~2,300), was a very good return relative to recent years based on the average run timing.
CN return:	Close to the 12 year average (~1,100), the count was pretty high for how early the swim was, indicating a strong return.

19.3. Spawner Distribution

Run Timing:

Table 19-3. The run timing for the survey year by species.

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye							
Coho					Mid Nov		
Pink							
Chum						Late Oct	Early Nov
Chinook							Early Nov

Comments: No surveys were conducted between September 24 and November 1.

Spatial Distribution:

Table 19-4. The survey sections used by spawners per species.

Species	Survey Section(s) used for spawning
Sockeye	
Coho	Lucky Pool, Boulder Pool, 14-11 (including ox bow), 7-5
Pink	
Chum	13-11, 7-5, 2-0
Chinook	Ice pool, run below log jam, boulder pool,13-12
Steelhead	

No surveys were conducted between September 24 and November 1. Peak spawning not observed for any species.

19.4. Environmental Conditions

Weather Summary: None

Physical Characteristics Update: None

19.5. Update to Stream Survey Protocols

Current Assessment Method:	Snorkel from Ice Pool (26) to mouth, markers only in from 15 to 0.
Deviations from current assessment protocols:	None
Access Updates:	None
Safety Update:	None

19.6. Enhancement

Brood Removal:	No CN brood, took CO brood (70k eggs)
Other Activities:	Restoration was done, two culverts removed above marker 18.

19.7. Biosamples

11/01: Collected 10 biosamples

19.8. Concerns and Comments

20. MOYEHA RIVER

20.1. Stream Summary

The Moyeha River flows southwest into Moyeha Bay at the head of Herbert Inlet in Clayoquot Sound. The system is located in the traditional territory of the Ahousaht First Nation and in Strathcona Provincial Park. Access is available only by boat or float plane and the town of Tofino is about 30 km to the south.

The mainstem is almost 30 km in length and is fed by many short, steep tributaries originating in the surrounding mountains. The lower Moyeha has a low gradient with wide sand and gravel banks. The gradient becomes slightly steeper above about 6 km from the mouth, and about 14 km from the mouth there is a canyon that is considered a migration barrier (above survey marker 27).

Compared to other streams in the area, Moyeha has generally moderate flow; slightly more flow than the Cypre River and less than Bedwell System. The water clarity and retainment characteristics are similar to Bedwell, Cypre and Tranquil; it is generally clear but will become murky after heavy rain and take up to three days to clear.

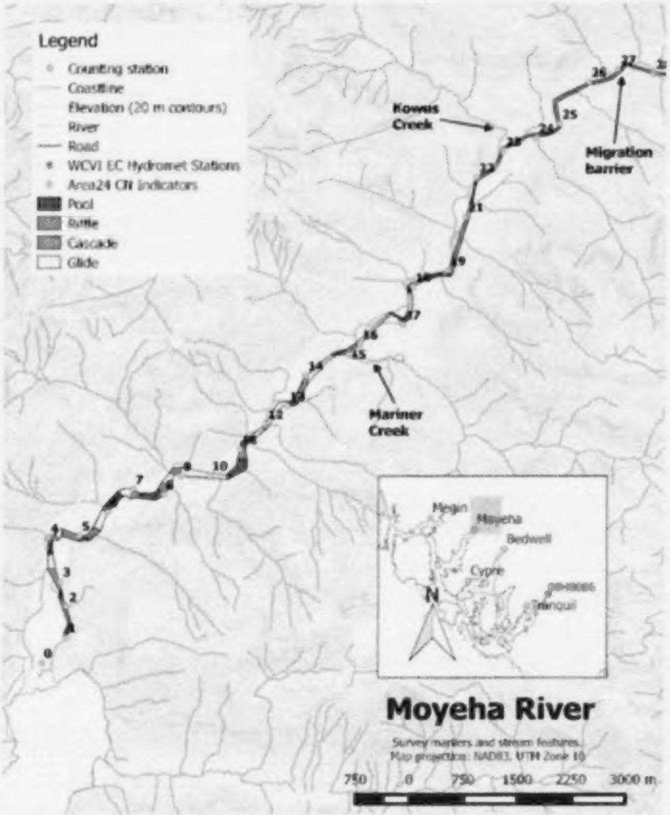

Legend
Counting station
Coastline
Elevation (20 m contours)
River
Road
WCVI EC Hydromet Stations
Area24 CN Indicators
Pool
Riffle
Cascade
Glide
Kowus Creek
Migration barrier
Mariner Creek
0
2
3
4
5
7
10
12
14
15
16
17
19
21
22
24
25
26
27
Megin
Moyeha
Bedwell
Cypre
Tranquil
N
Moyeha River
Survey markers and stream features.
Map projection: NAD83, UTM Zone 10
750
0
750
1500
2250
3000 m

Figure 20-1. Moyeha River counting stations and habitat units. Map inset shows locations of other systems that are regularly surveyed in Area 24 as well as the location of the Environment Canada hydrometric station at Tofino Creek (08HB086). Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. Habitat data were mapped in the field and / or digitized from recent high resolution orthophotographs by M.C. Wright and Associates Ltd.

The watershed is mostly old growth forest which has been largely untouched by logging. Despite this, the Moyeha changes a lot physically and is subject to erosion. Historically, the habitat included pools but in recent years the pools have mostly been filled in. Past surveyor reports often note erosion and scouring.

20.2. Escapement Estimates

Survey Crew: TCES (DH, SW, DP, CB)
Stock Assessment Biologist: Diana McHugh

Table 20-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
11-Sep-16	220	1	157		1		18		50	
26-Sep-16	194		1232				921	9	125	

Comments: Stream/Bank walks

20.3. Escapement Comments

Moyeha (in the upper section counted 5 clipped out of 17 adults observed)

Surveys before the CN peak

20.4. Environmental Conditions

20.5. Survey Protocols

Snorkel 13.5km from the canyon (Marker 27) down to the mouth (Marker 0).

20.6. Enhancement/Restoration Activities

20.7. Concerns and Comments

21. LOST SHOE CREEK

21.1. Stream Summary

Lost Shoe Creek flows WE into Florencia Bay, to the southeast of Tofino, and is located in the Pacific Rim National Park. The creek is primarily used by Coho and Chum. The system is difficult to survey, with poor water clarity, low light and lots of woody debris. The system is mostly shallow, but has a few deep pools. There has been a lot of restoration work done.

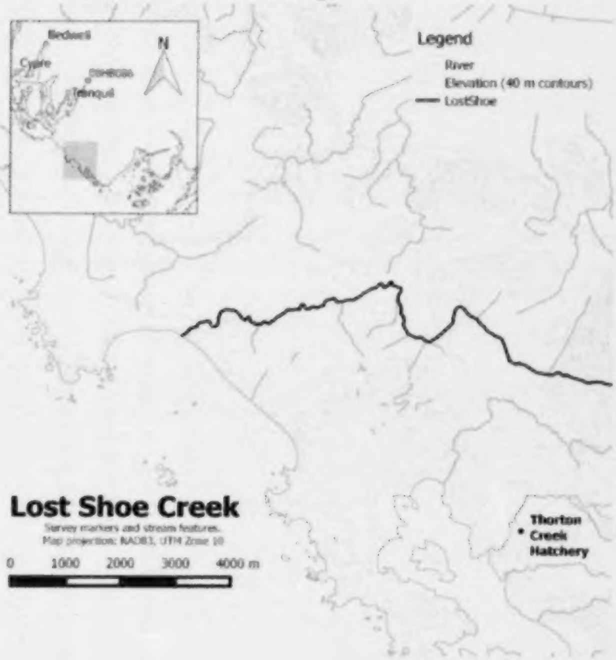

Bedwell
Cypre
08HB086
Tranquil
N
Legend
River
Elevation (40 m contours)
LostShoe
Lost Shoe Creek
Survey markers and stream features.
Map projection: NAD83, UTM Zone 10
0
1000
2000
3000
4000 m
Thorton Creek Hatchery

Figure 21-1. Location of Lost Shoe Creek. Map inset shows locations of other systems that are regularly surveyed in Area 24 as well as the location of the Environment Canada hydrometric station at Tofino Creek (08HB086). Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia

21.2. Escapement Estimates

Survey Crew: Central Westcoast Forest Society (E.Grubb, T. Balfour, J. Hutchinson, J.K. Ferris, K. Baldwin, S. Charleson, K. Porteous, M. Hayakawa, K. Kwasnecha, M. Hall, K. Howes)
Stock Assessment Biologist: Diana McHugh

Table 21-1. Unexpanded live and dead counts by species for each survey

Date	CO		CM	
	Live	Dead	Live	Dead
26-Oct-16	7		3	
09-Nov-16	8		15	4
16-Nov-16	12	3	78	125
23-Nov-16	6		22	15
30-Nov-16			13	8
07-Dec-16			1	5
14-Dec-16				
Raw PL+D	15		203	
Exp PL+D	23		254	

Comments: Stream/Bank walks

21.3. Survey Protocols

Survey of reach one (~300m)

22. SANDHILL CREEK

22.1. Stream Summary

Sandhill Creek flow northwest into Wickaninnish Bay, to the southeast of Tofino, and is located in the Pacific Rim National Park. It is one of the larger systems in Kennedy flats, with lots of tributaries. There are records of small numbers of spawning Coho, and occasionally Chum. .A shallow gravel, constructed spawning platform has been constructed under the bridge. The water is fairly clear and it is a very sandy stream with poor spawning gravel quality.

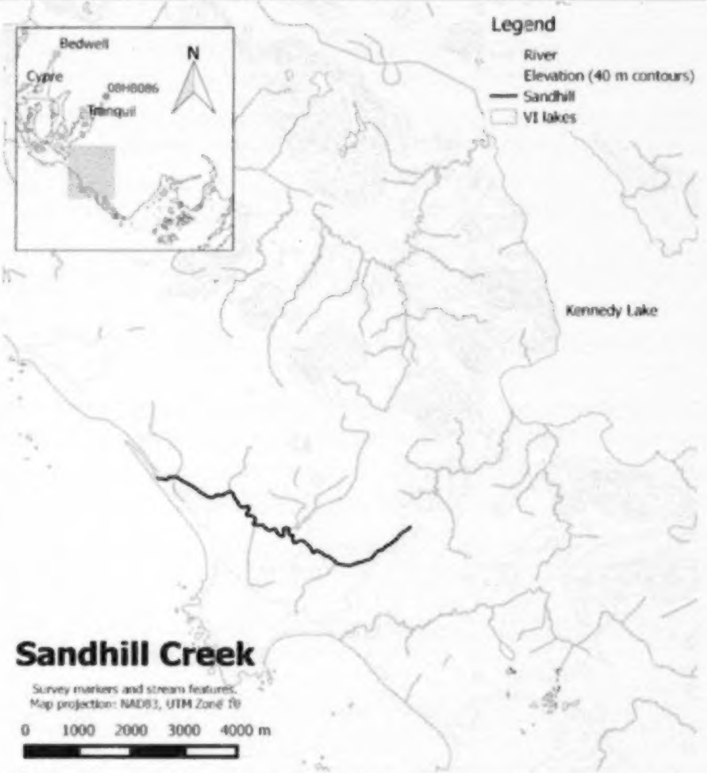

Legend
River
Elevation (40 m contours)
Sandhill
VI lakes
Bedwell
Cypre
08HB086
Tranquil
N
Kennedy Lake
Sandhill Creek
Survey markers and stream features.
Map projection: NAD83, UTM Zone 10
0
1000
2000
3000
4000 m

Figure 22-1. Location of Lost Shoe Creek. Map inset shows locations of other systems that are regularly surveyed in Area 24 as well as the location of the Environment Canada hydrometric station at Tofino Creek (08HB086). Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia.

22.2. Escapement Estimates

Survey Crew: Central Westcoast Forest Society (E.Grubb, T. Balfour, J. Hutchinson, J.K. Ferris, K. Baldwin, S. Charleson, M. Hayakawa, K. Kwasnecha, M. Hall, K. Howes)
Stock Assessment Biologist: Diana McHugh

Table 22-1. Unexpanded live and dead counts by species for each survey.

Date	CO		CM	
	Live	Dead	Live	Dead
27-Oct-16			3	
9-Nov-16			13	
16-Nov-16	2		17	2
23-Nov-16	2		24	2
30-Nov-16			9	3
7-Dec-16	2		2	1
Raw PL+D	2		26	
Exp PL+D	4		32	

22.3. Escapement Comments

Doug saw 22 CM spawning at the bridge Nov 6. Dave saw 17 CM and 4 CO on Nov 16, then a week later saw 6 CO.

22.4. Environmental Conditions

22.5. Survey Protocols

Spot check under Wick Road Bridge (10m).

22.6. Enhancement/Restoration Activities

Spawning platform constructed July 2016. Bridge put in in early spring 2016, used to be a seasonal barrier to passage.

22.7. Concerns and Comments

23. KENNEDY LAKE

23.1. Stream Summary

Kennedy Lake flows into the Lower Kennedy River in a westerly direction. The area of the lake is 6542 ha and the perimeter is 133.5 km.

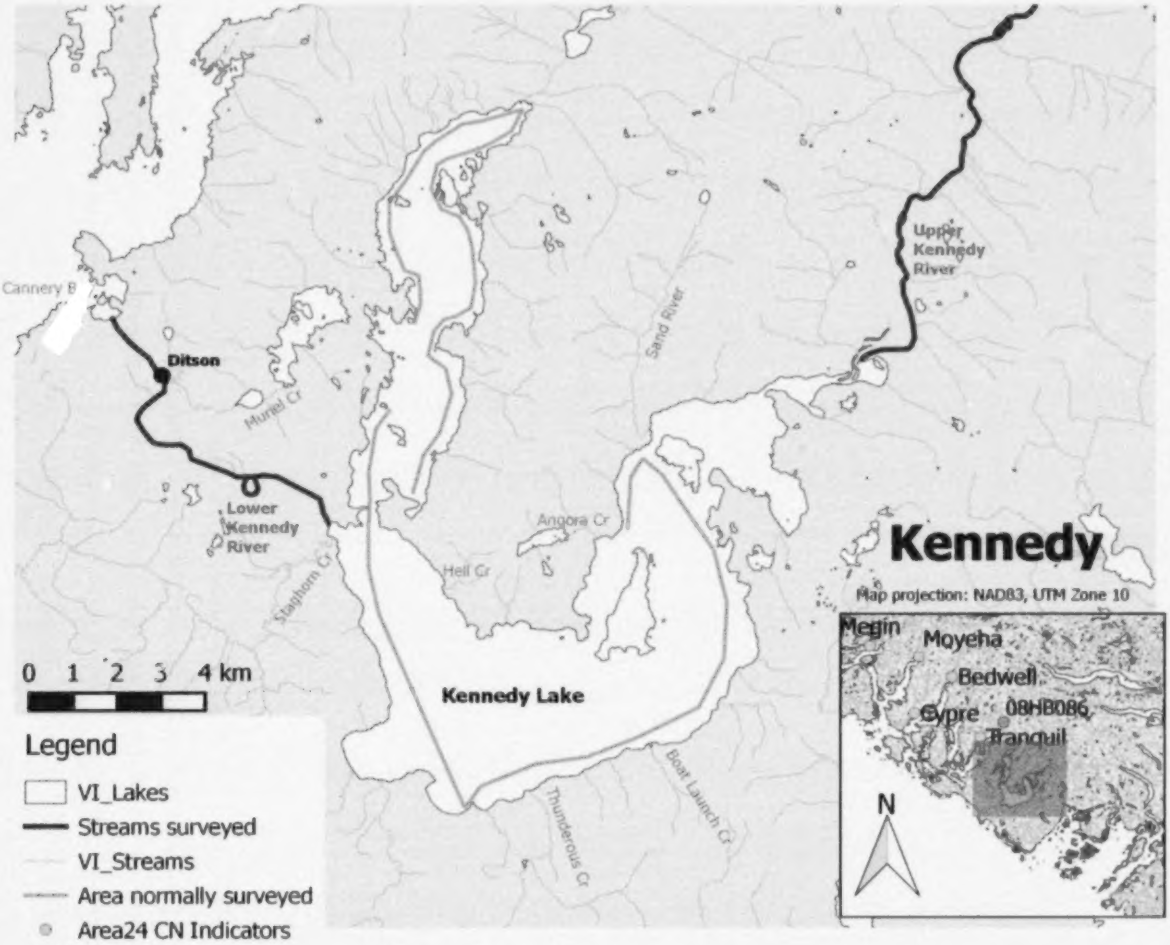

Cannery B
Ditson
Muriel Cr
Lower Kennedy River
Staghorn Cr
Hell Cr
Angora Cr
Sand River
Upper Kennedy River
Kennedy Lake
Thunderous Cr
Boat Launch Cr
0 1 2 3 4 km
Kennedy
Map projection: NAD83, UTM Zone 10
Megin
Moyeha
Bedwell
Cypre
08HB086
Tranquil
N
Legend
VI_Lakes
Streams surveyed
VI_Streams
Area normally surveyed
Area24 CN Indicators

Figure 23-1. The Kennedy Lake survey. Map inset shows locations of other systems that are regularly surveyed in Area 24 as well as the location of the Environment Canada hydrometric station at Tofino Creek (08HB086). Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia.

23.2. Escapement Estimates

Survey Crew: TCES (D. Palfrey, D. Hurwitz, R. Bisaro, E. Blake, D. Redpath)
Stock Assessment Biologist: Diana McHugh

It is the first time in 40 years that a 6 km boat survey of the Kennedy Lake shoreline didn't occur.

- Oct 31, 2016: Partial boat survey of shoreline from Kennedy Lake boat ramp ~0.5km along the shore, saw ~200 SK
- Nov 6, TCES attempted a two boat survey, but water was too high and visibility was too poor. The lake was in the parking lot.

23.3. Escapement Comments

Hatchery staff checked the mouth of Angora, Staghorn, and Muriel. CO numbers weren't very high saw a few hundred, though visibility was poor. Joe checked Thunderous and saw some Coho at the mouth, may have some spawning habitat at the bottom, very flashy but doesn't change course as much as it used to.

TCES checked Hell Creek on Nov 12 and saw big CO.

Lower Kennedy CN- hatchery est. 900+, majority females, seems to be recovering (~25% males), SK: based on an estuary est by boat ~7,000 in Cannery Bay (A. Jackson), SK were stuck in Cannery Bay due to low water in August then water came up and interfered with assessment.

10 lb (big) Coho in a tiny creek on West Main (A. Jackson)

23.4. Environmental Conditions

23.5. Survey Protocols

23.6. Enhancement/Restoration Activities

23.7. Concerns and Comments

AERIS was installed in Kennedy River at the hatchery, the images were problematic, too many shadows and milling rather than migrating through. They will try to put in a fence next year. The design is in development, and they may be able to use some wings may help to direct them into the ensonified area.

Saw quite a few seals going through the AERIS area. Seals come back when the SK return, some go up to the Upper Kennedy including the side channel. Sea lions as high as the bridge on Lower Kennedy. Saw seals at the spawning area in the lake (Erica Blake has email report-date).

This is large system with a lot of spawning habitat that does not get a lot of assessment.

Tla-o-qui-aht would like to see the CN and SK recovered sufficiently to support a food fishery. A lot of different stocks, more information is needed to support management decisions to support a sustainable fishery.

24. UPPER KENNEDY RIVER

24.1. Stream Summary

Upper Kennedy River flows into Kennedy Lake from the northwest.

24.2. Escapement Estimates

Survey Crew: TCES (D. Palfrey, and D. Hurwitz)
Stock Assessment Biologist: Diana McHugh

Table 24-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
15-Aug-16	1776	1								
05-Sep-16	2592								1	
01-Dec-16	3	8	626	49						
16-Dec-16			511	51			1			
Raw PL+D	2,592		675				1		1	
Exp PL+D	2,880		750				1		1	

24.3. Escapement Comments

SK: 2,880 Exp PL+D, low return compared to historical observations

CO: 750 Exp PL+D, Roughly half of the 12 year average (~1400)

24.4. Environmental Conditions

24.5. Survey Protocols

24.6. Enhancement/Restoration Activities

24.7. Concerns and Comments

Will have a SK Risk Assessment meeting in May. The system is changing (observing declines in CO), more on the ground experience would be useful to have at the workshop.

25. COHO CREEK

25.1. Stream Summary

Coho Creek flows into Grice Bay and historically had a relatively abundant Coho return. The upper watershed is still old growth, but the lower section is disturbed (once the highway was paved, the number of coho declined). Some restoration work has been done including wood removal and gravel restoration in 2015. The creek is very clear and shallow; the bottom of all the pools can be seen. A 500 m section is surveyed from the bank.

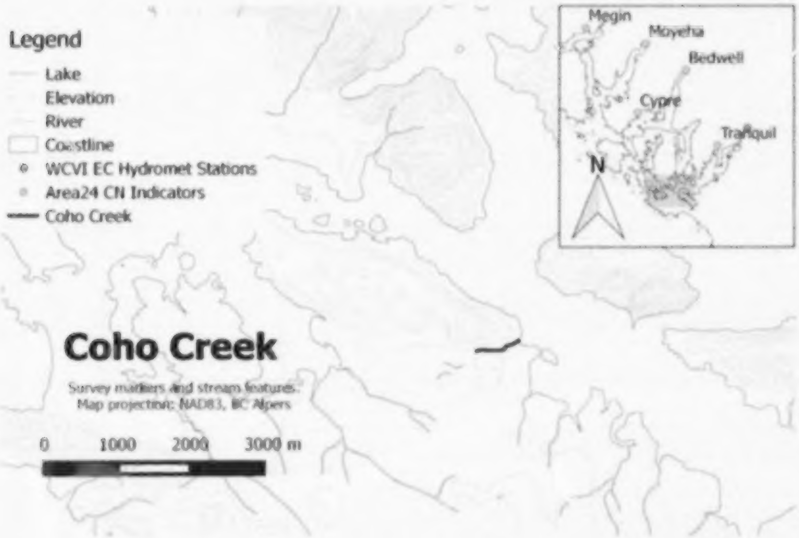

Legend
Lake
Elevation
River
Coastline
WCVI EC Hydromet Stations
Area24 CN Indicators
Coho Creek
Coho Creek
Survey markers and stream features.
Map projection: NAD83, BC Albers
0
1000
2000
3000 m
Megin
Moyeha
Bedwell
Cypre
Tranquil
N

Figure 25-1. Coho Creek. Map inset shows locations of other systems that are regularly surveyed in Area 24 as well as the location of the Environment Canada hydrometric station at Tofino Creek (08HB086; orange circle). Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia.

25.2. Escapement Estimates

Survey Crew: Central Westcoast Forest Society (E.Grubb, T. Balfour, J. Hutchinson, J.K. Ferris, K. Baldwin, S. Charleson, M. Hayakawa, K. Kwasnecha, D. Stephanian, M. Ross)
Stock Assessment Biologist: Diana McHugh

Table 25-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
25-Oct-16										
10-Nov-16			3							
14-Nov-16			11							
21-Nov-16			10	1						
28-Nov-16			2	3						
5-Dec-16										
12-Dec-16										
Raw PL+D			11							
Exp PL+D			17							

25.3. Escapement Comments

CO: Fish are on the smaller side compared to other systems.

25.4. Environmental Conditions

25.5. Survey Protocols

Stream/Bankwalk (500m)

25.6. Enhancement/Restoration Activities

Restoration (spawning gravel and LWD placement), three fish barriers removed. Worked since 2010 (Dave Clough).

25.7. Concerns and Comments

CWFS has done walks in previous years, only saw a couple CO, so the numbers were better this year. Tried a smolt trap in 2013 or 2014 but stream is flashy and they had some juvenile mortality, so pulled it.

26. WARN BAY CREEK

26.1. Stream Summary

Warn Bay Creek flows into Warn Bay at the north end of Fortune Channel in Clayoquot Sound. The mainstem length is 4500 m. The lower 1000 m consists of a low gradient with pebble and rock substrate. River is small, can be surveyed even when Tranquil is too high to survey.

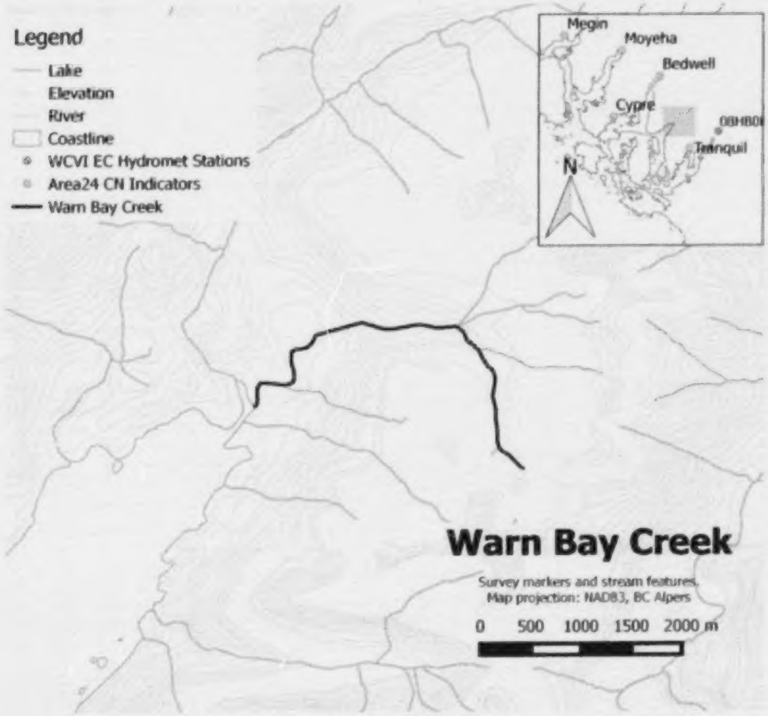

Legend
Lake
Elevation
River
Coastline
WCVI EC Hydromet Stations
Area24 CN Indicators
Warn Bay Creek
Megin
Moyeha
Bedwell
Cypre
08HB0
Tranquil
N
Warn Bay Creek
Survey markers and stream features.
Map projection: NAD83, BC Alpers
0 500 1000 1500 2000 m

Figure 26-1. Warn Bay Creek. Map inset shows locations of other systems that are regularly surveyed in Area 24 as well as the location of the Environment Canada hydrometric station at Tofino Creek (08HB086; orange circle). Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia.

26.2. Escapement Estimates

Survey Crew: TCES (Doug Palfrey)
Stock Assessment Biologist: Diana McHugh

Table 26-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
22-Oct-16			34				1882	165	17	
28-Oct-16			30				2130	427	10	5
14-Nov-16			16				35	246	1	
Raw PL+D			34				2,557		17	
Exp PL+D			52				3,196		26	

26.3. Escapement Comments

CO: 52 Exp PL+D, similar to the 12 year average.

CM: 4,077 Exp AUC, similar to the 12 year average. (Level 2)

CN: 26 Exp PL+D, similar to the 12 year average. The Oct 22 should have been the peak (Level 2)

26.4. Environmental Conditions

26.5. Survey Protocols

500 metre snorkel survey

26.6. Enhancement/Restoration Activities

None

26.7. Concerns and Comments

7 adclipped CN observed Oct 22

4 adclipped CN observed Oct 28

5 adclips recovered (1 is possibly a misclip)

27. SYDNEY INLET RIVER

27.1. Stream Summary

Sydney Inlet River flow southeast into the head of Sydney Inlet. The mainstem is 12.8 km long and it is fed by Irving Lake and the surrounding mountains. The system is clear with low flow (40CT at low flow).

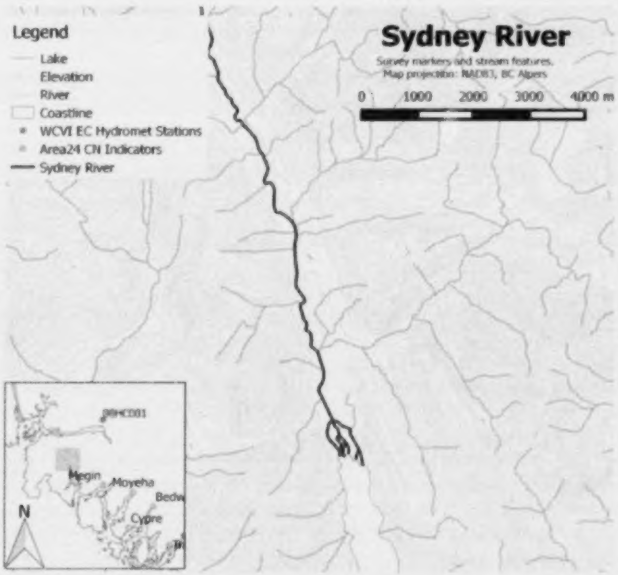

Legend
Lake
Elevation
River
Coastline
WCVI EC Hydromet Stations
Area24 CN Indicators
Sydney River
Sydney River
Survey markers and stream features.
Map projection: NAD83, BC Albers
0
1000
2000
3000
4000 m
08HC001
Megin
Moyeha
Bedw
Cypre
N

Figure 27-1. Sydney River. Map inset shows locations of other systems that are regularly surveyed in Area 24 as well as the location of the Environment Canada hydrometric stations at Tofino Creek and Gold River (08HB086, 08HC001; orange circles). Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia.

27.2. Escapement Estimates

Survey Crew: Rufus Charleson, P.L.
Stock Assessment Biologist: Diana McHugh

Table 27-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
Sept 28			282				12		10	

27.3. Escapement Comments

CO: majority of CO were spawned out

27.4. Environmental Conditions

A couple of log jams; one at the lower end (barrier to CN) and another about 500 m up.

27.5. Survey Protocols

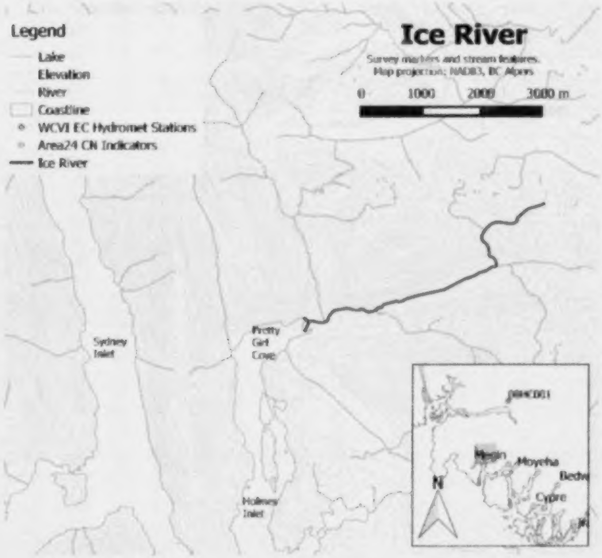
~1000m walk in about 3 hours

27.6. Enhancement/Restoration Activities

27.7. Concerns and Comments

154 CO fry in the upper river and 40 cutthroat trout

28. ICE RIVER


Legend
Lake
Elevation
River
Coastline
WCVI EC Hydromet Stations
Area24 CN Indicators
Ice River
Ice River
0
1000
2000
3000 m
Sydney Inlet
Pretty Girl Cove
Holmes Inlet
08HC001
Megin
Moyeha
Bedw
Cypre
N

28.1. Stream Summary

Ice River flow into the head of Pretty Girl Cove in Holmes Inlet. The mainstem is 5.8km and is fed by Camp Lake, Ice Lake and Pretty Girl Lake.

Figure 28-1. Ice River. Map inset shows locations of other systems that are regularly surveyed in Area 24 as well as the location of the Environment Canada hydrometric stations at Tofino Creek and Gold River (08HB086, 08HC001; orange circles). Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia.

28.2. Escapement Estimates

Survey Crew: Charleson, P.L.
Stock Assessment Biologist: Diana McHugh

Table 28-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
Oct. 4							4			

28.3. Escapement Comments

28.4. Environmental Conditions

Survey done at high flow with poor observation conditions.

28.5. Survey Protocols

Walked 200m

28.6. Enhancement/Restoration Activities

28.7. Concerns and Comments

Surveyors noted quite a few CO and CM jumping in the estuary.

29. AYYI SAQH (HESQUIAT HARBOUR #2 CREEKS)

29.1. Stream Summary

29.2. Escapement Estimates

Survey Crew: Rufus Charleson, P.L.
Stock Assessment Biologist: Diana McHugh

Table 29-1. Unexpanded live and dead counts by species for each survey.

Date	**SK**		**CO**		**PK**		**CM**		**CN**	
	Live	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**
Nov. 1							327	219		

29.3. Escapement Comments

CM: most were in sections 9-24

29.4. Environmental Conditions

High flow during survey. Log jams in sections 27, 28 and 29. A log jam in section 32 is building up and accumulating large/small cobbles in the jam.

29.5. Survey Protocols

In 2016, surveyors walked to section 37 (sections are 3m apart).

Includes the side channel (at section 10-11).

29.6. Enhancement/Restoration Activities

29.7. Concerns and Comments

Log jams need to be removed

On the left bank looking upstream there is erosion in section 30.

30. TSA-YA (HESQUIAT LAKE CREEK)

30.1. Stream Summary

30.2. Escapement Estimates

Survey Crew: Rufus Charleson, P.L.
Stock Assessment Biologist: Diana McHugh

Table 30-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**
Oct. 15							1200	150		

30.3. Escapement Comments

Fairly good CM return, didn't get any CO counts because they in the upper river which was inaccessible due to high water.

30.4. Environmental Conditions

30.5. Survey Protocols

Bank walk to marker 9.

30.6. Enhancement/Restoration Activities

30.7. Concerns and Comments

Alot of woody debris is coming down due to the flooding, concerned about scouring. Log jam still building. Washout going into Tsa-ya, needs remediation.

STREAMS IN AREA 25

31. AREA 25 SUMMARY OF OBSERVATIONS IN 2015

31.1. Overview

There almost 60 streams and major tributaries in Area 25 with records of spawning salmon. The priority for escapement enumeration are the Chinook indicator stocks Burman River, Leiner River and Tahsis River. Additional systems are surveyed when funding allows and typically less frequently than the indicator systems. Most systems are surveyed using the snorkel method described in the DFO snorkel survey manual. Occasionally systems are also surveyed by stream or bank walks.

The Conuma Hatchery enhances Chinook populations in the Burman River, Conuma River and Gold River. Prior to 2015, the Conuma Hatchery also enhanced Sucwoa, Tlupana, and Canton Chinook, but they stopped because biosamples results showed the majority of fish returning to those systems were from the Conuma Hatchery release. The Tahsis Enhancement Society enhances populations in the Tahsis and Leiner Rivers.

31.2. 2016 Operational Summary

In 2015, 13 systems were surveyed in Area 25 (Figure 31-1). The three indicators as well as Zeballos, Conuma and Canton were surveyed frequently enough to allow a reliable application of the Area Under the Curve (AUC) estimation method for most species. Other systems were surveyed less frequently with the intent of making a less reliable, minimum estimate of escapement, usually based on the expanded Peak Live + Dead count. Surveys are typically conducted by DFO contractors, First Nations and local enhancement groups.

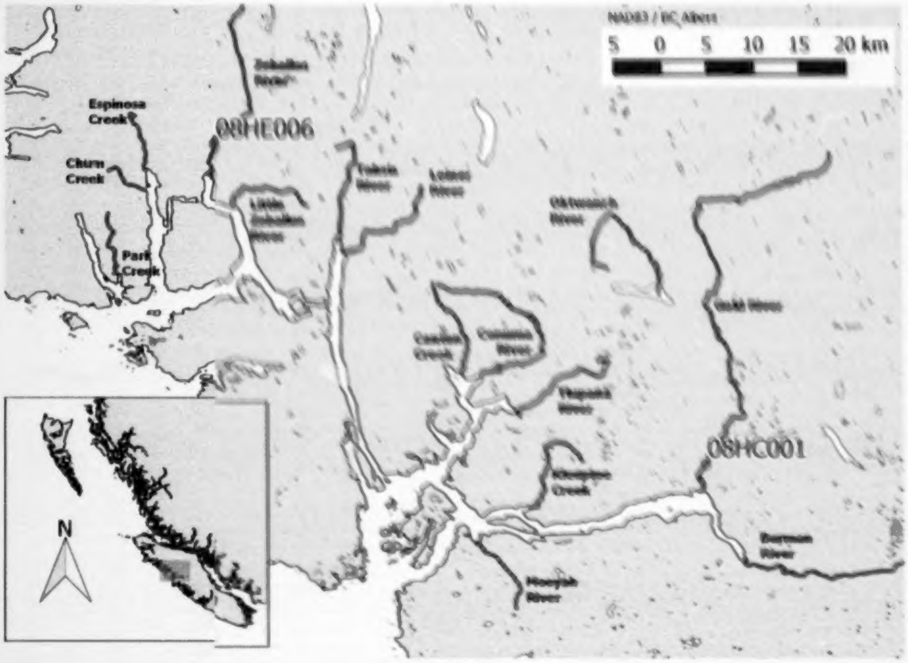

NAD83 / BC Albers
5 0 5 10 15 20 km
Zeballos River
Espinosa Creek
08HE006
Churn Creek
Park Creek
Little Zeballos River
Tahsis River
Leiner River
Oktwanch River
Gold River
Canton Creek
Conuma River
Tlupana River
08HC001
Burman River
Mooyah River
N

Figure 31-1. Streams in Area 25 that were surveyed in 2015. Environment Canada Hydromet stations on the Gold River (08HC001) and Zeballos River (08HE006) indicate flow on nearby ungauged systems. The blue circle marks the location of the major enhancement facility at Conuma.

Surveys early in the season occurred as scheduled; however a series of major rain events disrupted surveys in mid to late-October (Figure 31-2). While water levels and temperature were conducive to migration throughout the escapement season, they were too high for high quality surveys through much of October due to a series of major storms. Estimates of sockeye, coho, and chinook should be fairly good given the available surveys, but the chum peak was likely missed in a number of systems. Salmon returns in Area 25 were generally good relative to the 12 year average in 2016, except for coho in Conuma and possibly Burman; and pinks which were largely absent this year.

Table 31-1. Escapement: Raw Peak Live + Dead Adult counts by statweek and Preliminary Escapement Estimates, font indicates the level of spawning observed. Underline: 1-9% spawning, Italics: 10-49% spawning, Bold: >50% spawning.

Colour codes for escapement method and plan	
Bank Walk	Helicopter
Stream Walk	Fence
Snorkel	Missed
Boat	Revised plan

Colour codes for esc. Est. compared to the 12 year avg.
> 125%
75%-125%
50%-75%
25%-50%
<25%

System	Species	9-1 Aug 28-Sep 3	9-2 Sept 4-10	9-3 Sept 11-17	9-4 Sept 18-24	10-1 Sept 25-Oct 1	10-2 Oct 2-8	10-3 Oct 9-15	10-4 Oct 16-22	10-5 Oct 23-29	11-1 Oct 30-Nov 5	Esc Est
BURMAN RIVER	Sockeye	10	112	935	*1253*	393	1048					1,400
LEINER RIVER	Sockeye		924	1050	2258		1721	589			**674**	2,509
CANTON CREEK	Sockeye		2		1	6		13			1	17
CONUMA RIVER	Sockeye		51	30	19	14		38				57
TAHSIS RIVER	Sockeye		436	354	348	339		359			**327**	484
CHUM CREEK	Sockeye				0					0		
ESPINOSA CREEK	Sockeye			0	0							
KLEEPTEE CREEK	Sockeye			0	0		8					
LITTLE ZEBALLOS RIVER	Sockeye					**107**	**113**					125
MOOYAH RIVER	Sockeye			0								
OKTWANCH RIVER	Sockeye							108				110
PARK RIVER	Sockeye									**36**		
ZEBALLOS RIVER	Sockeye			0	150	**840**	**1700**		5			2,000

System	Species	9-1 Aug 28-Sep 3	9-2 Sept 4-10	9-3 Sept 11-17	9-4 Sept 18-24	10-1 Sept 25-Oct 1	10-2 Oct 2-8	10-3 Oct 9-15	10-4 Oct 16-22	10-5 Oct 23-29	11-1 Oct 30-Nov 5	Esc Est
BURMAN RIVER	Coho	0	12	416	316	315	90					500
LEINER RIVER	Coho		409	380	1369		795	681			569	1,521
CANTON CREEK	Coho		127		209	293		516			395	782
CONUMA RIVER	Coho		47	107	624	443		946				1,288
TAHSIS RIVER	Coho		250	164	380	315		481			640	1,188
CHUM CREEK	Coho				0					6		6
ESPINOSA CREEK	Coho			0	0							0
KLEEPTEE CREEK	Coho			1	0		11					11
LITTLE ZEBALLOS RIVER	Coho					25	556					575
MOOYAH RIVER	Coho			0								
OKTWANCH RIVER	Coho							0				
PARK RIVER	Coho									248		250
ZEBALLOS RIVER	Coho			0	20	152	591		33			600

Table 31-1 continued

System	Species	9-1 Aug 28-Sep 3	9-2 Sept 4-10	9-3 Sept 11-17	9-4 Sept 18-24	10-1 Sept 25-Oct 1	10-2 Oct 2-8	10-3 Oct 9-15	10-4 Oct 16-22	10-5 Oct 23-29	11-1 Oct 30-Nov 5	Esc Est
BURMAN RIVER	Chum	0	230	*1027*	**2000**	2000	1823					4,000
LEINER RIVER	Chum		132	*157*	1180		*1033*	***5056***			**1606**	7,911
CANTON CREEK	Chum		20		168	357		**2004**			**369**	3,048
CONUMA RIVER	Chum		25	119	872	866		*7761*				13,628
TAHSIS RIVER	Chum		5	13	249	264		*3041*			**4301**	7,582
CHUM CREEK	Chum				0					**4316**		4,500
ESPINOSA CREEK	Chum			0	**6**							
KLEEPTEE CREEK	Chum			350	58		399					800
LITTLE ZEBALLOS RIVER	Chum					*887*	843					1,000
MOOYAH RIVER	Chum			0								
OKTWANCH RIVER	Chum							0				
PARK RIVER	Chum									**10623**		11,000
ZEBALLOS RIVER	Chum			0	40	*4021*	**9231**	5000	16297			20,000

System	Species	9-1 Aug 28-Sep 3	9-2 Sept 4-10	9-3 Sept 11-17	9-4 Sept 18-24	10-1 Sept 25-Oct 1	10-2 Oct 2-8	10-3 Oct 9-15	10-4 Oct 16-22	10-5 Oct 23-29	11-1 Oct 30-Nov 5	Esc Est
BURMAN RIVER	Chinook	1160	708	*5468*	**5063**	5245	811					8,000
LEINER RIVER	Chinook		1300	***901***	***614***		*267*	**71**			6	1,465
CANTON CREEK	Chinook		4124		**8303**	**2272**		*2872*			**2**	9,226
CONUMA RIVER	Chinook		17189	*10712*	13722	4895		**746**				22,292
TAHSIS RIVER	Chinook		84	*82*	*187*	**140**		84			2	256
CHUM CREEK	Chinook				2					0		
ESPINOSA CREEK	Chinook			0	0							
KLEEPTEE CREEK	Chinook			2	3		21					25
LITTLE ZEBALLOS RIVER	Chinook					215	95					230
MOOYAH RIVER	Chinook			0								
OKTWANCH RIVER	Chinook							6				6
PARK RIVER	Chinook									0		
ZEBALLOS RIVER	Chinook			1	253	9	155		1			275

Commentary on #s, spawning extent, holding duration, survey quality, fish condition, brood removal, sex ratio:

- Chinook: Extensive spawning in all known habitats in the Tahsis, Leiner and Canton, all suitable gravel bars well-excavated
- Pink: seen occasionally, but only at very low numbers (a cumulative total of 13 seen in Nootka/Esperanza this year versus 88 seen in 2015).

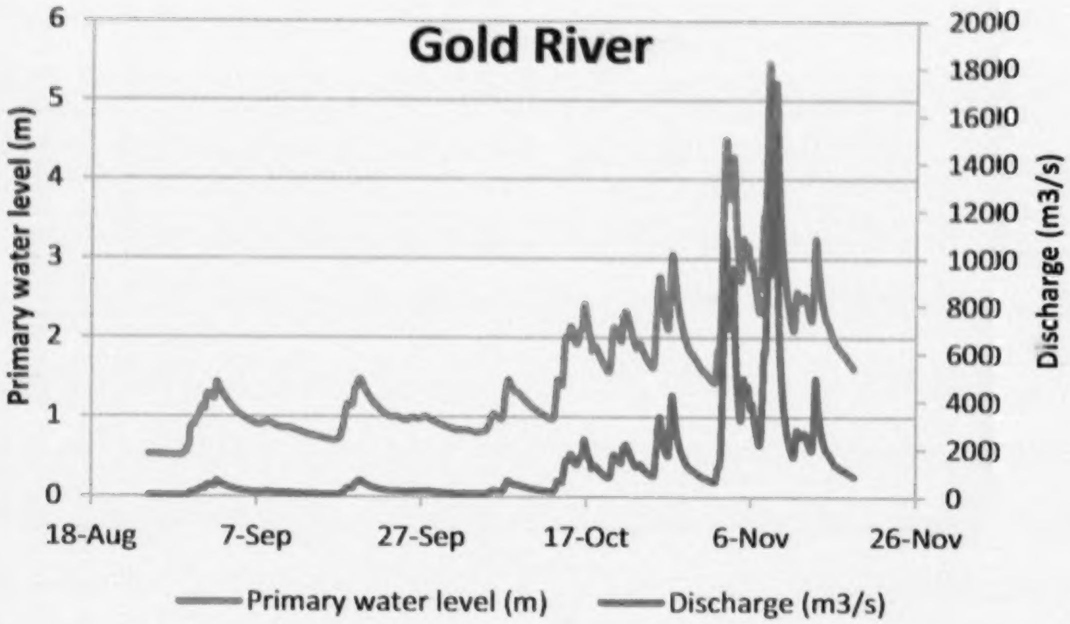


Figure 31-2. Gold River water level and discharge (08HC001), snorkel surveys in Tahsis and Leiner are not recommended when Gold River discharge exceeds 190 m^3/s.

Table 31-2. Area 24 escapement survey plan matrix for 2016.

Planned Surveys/Activities

☐ AFS - Ditidaht
☐ AFS - Tseshaht
☐ AFS - Hupacasath
☐ Huu-ay-aht
☐ DFO Contract
☐ External non-DFO (NTC, Maa-nulth, etc.)
☐ External DFO/BC (SEP, MOF)

paler shade=cancelled
paler shade+cross hatch=rescheduled, but completed
▨ survey completed data received

Stat Area	First Nation Territory	Stream Name	September				October					November					December		Comments		
			9-1	9-2	9-3	9-4	10-1	10-2	10-3	10-4	10-5	11-1	11-2	11-3	11-4	11-5	12-1	12-2	Survey Type and Target	# Planned	# Done
25	Nuchatlaht	Inner Basin (BLACK CREEK)																	None in 2016-safety issue	0	
25	Nuchatlaht	BRODICK CREEK																	PL+D: Chum, C&P		
25	Mowachaht Muchalaht	BURMAN RIVER																	AUC: Chinook, chum, coho	10	6
25	Mowachaht Muchalaht	CANTON CREEK	snkl		snkl	snkl	snkl	snkl											Hatchery planning no activity in 2014	5	5
25	Ehattesaht	CHUM CREEK				snkl					snkl								PL+D: Chum, R Dunlop UAV, weekly Sept to Nov	8	3
25	Mowachaht Muchalaht	CONUMA RIVER	snkl		snkl	snkl	snkl	snkl		snkl									AUC: Chinook, chum, coho	6	5
25	Mowachaht Muchalaht	DESERTED CREEK																	Chum PL+D		
25	Ehattesaht	ELIZA CREEK																	PL+D: Chum,C&P (25-12)		
25	Hesquiaht	Escalante River																			
25	Ehattesaht	ESPINOSA CREEK								snkl									PL+D: Chum, weekly Sept to Nov	1	2
25	Ehattesaht	PARK RIVER						snkl		snkl									PL+D: Chum	2	1
25	Mowachaht Muchalaht	GOLD RIVER																	CN brood collection	0	
25	Ehattesaht	HAMMOND CREEK																			
25	Mowachaht Muchalaht	HOISS CREEK																			
25	Nuchatlaht	INNER BASIN RIVER																	None in 2015-safety issue		
25	Mowachaht Muchalaht	KENDRICK CREEK																			
25	Mowachaht Muchalaht	KLEEPTEE CREEK																	R Dunlop 3 trips (Aug 11, 2016)	3	3
25	Mowachaht Muchalaht	LEINER RIVER	snkl	snkl	snkl	snkl	snkl	snkl		snkl									AUC: Chinook, chum, coho	7	7
25	Ehattesaht	LITTLE ZEBALLOS RIVER				snkl		snkl	snkl		snkl								PL+D: Chum, + $3k for trail maintenance	4	3
25	Ehattesaht/Nuchatlaht	LORD CREEK																	PL+D: Chum, C&P		
25	Ehattesaht	MAMAT CREEK																	PL+D: Chum,C&P (25-11)		
25	Mowachaht Muchalaht	MARVINAS BAY CREEK																			
25	Mowachaht Muchalaht	MCCURDY CREEK																			
25	Ehattesaht	MIDDLE ELIZA CREEK																			
25	Mowachaht Muchalaht	MOOYAH RIVER																	R. Dunlop 3 trips (Aug 11, 2016)	3	1
25	Mowachaht Muchalaht	MUCHALAT RIVER																			
25	Mowachaht Muchalaht	OKTWANCH RIVER																	MMFN 2-3 SK snorkel surveys	3	1
25	Nuchatlaht	OWOSSITSA CREEK																	PL+D: Chum, C&P , weekly if possible		
25	Mowachaht Muchalaht	SUCWOA RIVER																	Hatchery planning only CN brood activity in 2014	0	
25	Mowachaht Muchalaht	TAHSIS RIVER	snkl	snkl	snkl	snkl	snkl	snkl		snkl									AUC: Chinook, chum, coho	7	7
25	Mowachaht Muchalaht	TLUPANA RIVER																	Chinook and chum brood collection/ biodiversity		
25	Mowachaht Muchalaht	TSOWWIN RIVER																	PL+D: Chum/Coho	0	
25	Ehattesaht	ZEBALLOS RIVER				snkl		snkl	snkl		snkl								PL+D: Chum, Ehattesaht CM brood, R Dunlop UAV	4	7

31.3. Escapement survey review meeting

The 2016 survey results from Area 25 were reviewed at a post-season escapement review workshop held at the Mowachaht/Muchalaht First Nation Band Office, Tsaxana, B.C. on March 29, 2017. Workshops participants (Table 15-3) reviewed and discussed the individual survey results and escapement estimates, then collaboratively filled in the commentary for each system that was surveyed. Participants also discussed quality of the observations and classified the estimates according to how they can be used for management purposes. Most of the commentary in the first section of each stream summary was derived from the stream narratives which have been completed by numerous surveyors over the past 20 years.

Additional issues discussed included:

- Roger Dunlop doesn't agree with the data quality classification system applied to the escapement estimates.
- Radio tag vs visual estimates generally agree well until the peak and then fish spread out and are more difficult count visually.
- Estimates from systems with mixed stocks have higher uncertainty. On some systems (e.g. Tahsis), the swimmers can circle back and count again, but on other systems (e.g. Conuma) this method doesn't work because the fish sulk after the first pass.
- Low flows and good visibility are essential conditions for collecting reliable escapement data. It is equally important to conduct surveys immediately after rain events because rising water levels in the fall are important migration and spawning cues for salmonids.

Table 31-3. Participants at the Area 25 escapement review workshop in Tsaxana, on March 29, 2017..

Participant	Affiliation
Jamieson Atkinson	BCCF
Frank Collins	Tahsis Enhancement Society
Chris Erickson	Conuma Hatchery
Shawn Hay	Escapement Contractor
Stephanie King	Sea This Consulting (organizer)
Jacob Knight	Conuma Hatchery
Diana McHugh	DFO (organizer)
Eamon Miyagi	DFO
Kadin Snook	Fisheries Coordinator, Mowachaht/Muchalaht First Nations
Lyndy Vroom	Conuma Hatchery

Figure 31-3. Participants of the Area 25 escapement review workshop, March 29, 2017.

32. TAHSIS RIVER

32.1. Stream Summary

The Tahsis River flows south into the head of Tahsis Inlet and is fed by many small tributaries and headwaters in the mountains. McKelvie Creek is the largest tributary which joins Tahsis about one kilometre from the mouth. The Environment Canada Hydromet station at Zeballos (08HE006) is a good indicator of flow on the Tahsis.

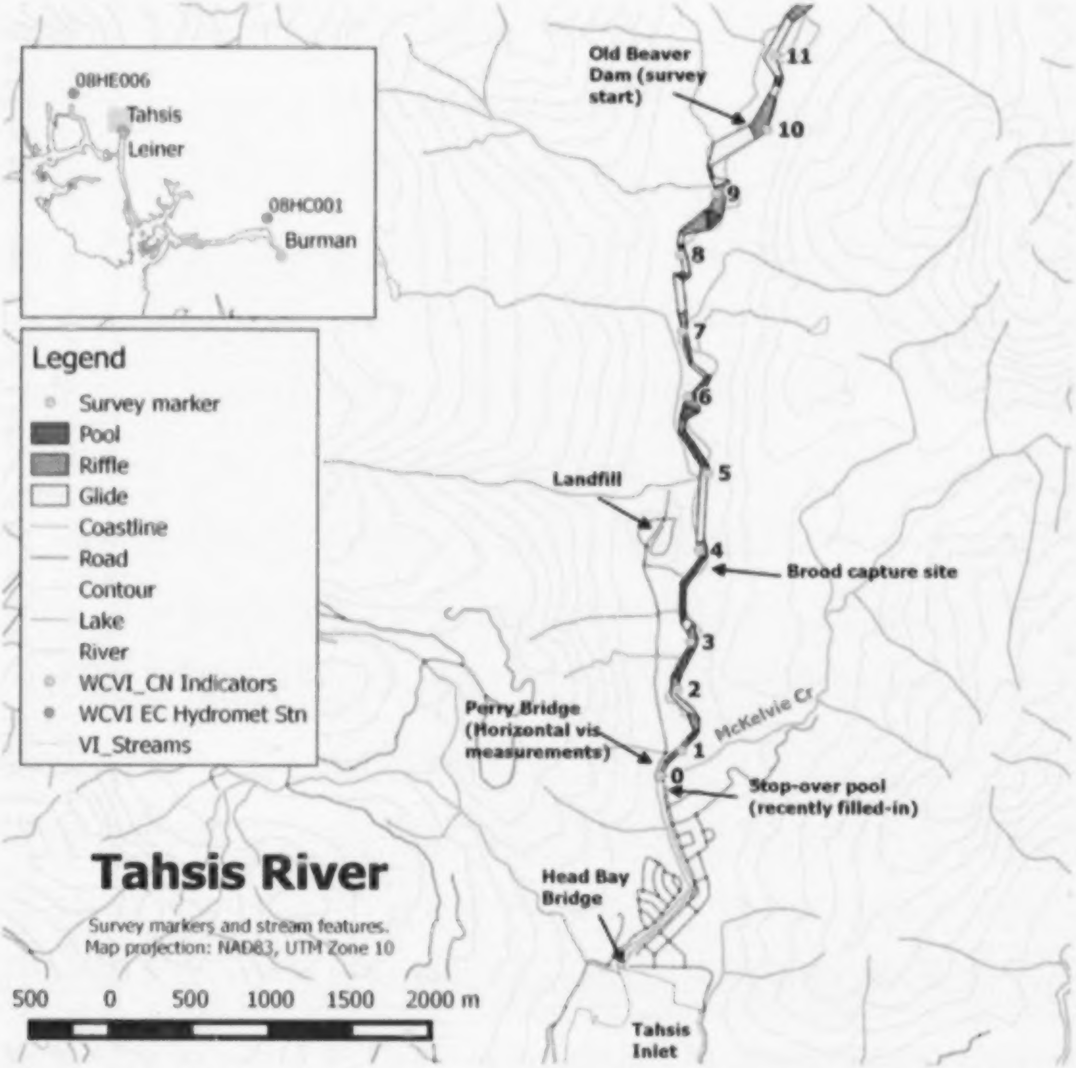

08HE006
Tahsis
Leiner
08HC001
Burman
Legend
Survey marker
Pool
Riffle
Glide
Coastline
Road
Contour
Lake
River
WCVI_CN Indicators
WCVI EC Hydromet Stn
VI_Streams
Old Beaver Dam (survey start)
11
10
9
8
7
6
5
Landfill
4
Brood capture site
3
2
Perry Bridge (Horizontal vis measurements)
1
McKelvie Cr
0
Stop-over pool (recently filled-in)
Head Bay Bridge
Tahsis Inlet
Tahsis River
Survey markers and stream features.
Map projection: NAD83, UTM Zone 10
500
0
500
1000
1500
2000 m

Figure 32-1. Tahsis River, habitat units and survey markers. Map inset show locations of other systems that are regularly surveyed in the area as well as the location of the nearby Environment Canada hydromet stations on the Gold River (08HC001) and Zeballos River near Zeballos (08HE006). Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. Habitat data were mapped in the field and / or digitized from recent high resolution orthophotographs by M.C. Wright and Associates Ltd.

Compared to the nearby Leiner River, the Tahsis is a slightly smaller system and clears more quickly than the Leiner after rain events. Water clarity in the Tahsis is exceptional. Turbidity increases after rain events but typically returns to normal after 48 hours. When the Zeballos discharge is less than 130 m^3/s, the Tahsis is typically swimmable, but surveyors check with locals regarding the Tahsis water level.

The survey area is 5 km in length and has been divided into 10 survey sections, each about 500 m apart. Marker 0 is located at the Perry Bridge at the north end of the town of Tahsis, and about 1.3 km upstream from the mouth. The survey section is primarily a low gradient (<1%) single channel comprised of repeating units of riffle/pool habitat. There are several areas that are heavily braided (sections 10/9 and 7/6) where the active channel can change year to year. While the survey sections represent most of the spawning grounds, local experts note that Chinook, Coho, Chum and Sockeye spawn outside of the area surveyed, including in McKelvie Creek and above the marker 10.

During extreme low flow periods in the late summer and early fall the river flow goes sub surface in the upper survey sections (i.e. usually above marker 9, above 8 in 2012). Didymo (*Didymosphenia geminata*) has been observed throughout the survey area Tahsis in recent years.

The Tahsis Salmon Enhancement Society in Tahsis has been actively carrying out salmon enhancement activities in the Leiner and Tahsis rivers since 1984.

32.2. Survey results and escapement estimate

Survey Crew: Shawn Hay, Gary Horncastle, Pete Law, Mike Lough
Stock Assessment Biologist: Diana McHugh

In 2016, the Tahsis River was snorkelled 7 times between September 7 and November 17 with an average survey frequency of 10 days. The spacing of rain events during September, October and November allowed crews to schedule swims at timely intervals and thereby closely track salmon migration throughout the fall season; we consider the data to be reliable. Rainfall amounts recorded from the DFO hydrometic site on the Conuma River were used as a proxy for all Area 25 streams.

Survey Data:

Table 32-1. Unexpanded live (L) and dead (D) counts by species for each survey, peak live plus dead (PL+D) raw and expanded for OE. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:
For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%; For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

			SK		CO		PK		CM		CN	
Date	**OE cat.**	**Comments**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**
Sep 7	Excellent	123 mm rain - Aug. 29 to Sep. 5 Water level normal (0.26m), water clear. Horizontal visibility 15+m, Vertical vis 5+m	436	0	250	0	3	0	5	0	84	0
Sep 16	Excellent	22 mm rain - Sep. 7 – 10 Water level normal (0.33m), water clear. Horizontal visibility 15m, Vertical vis 6m	354	0	164	0	1	0	13	0	82	8
Sep 23	Excellent	96 mm rain - Sep. 16 – 19 Water level normal (0.38m), water clear. Horizontal visibility 26m, Vertical vis 4m	348	0	380	0	0	0	249	0	186	1
Oct 1	Excellent	30 mm rain - Sep. 29 – Oct. 1 Water level normal (0.30m), water clear. Horizontal visibility 26m, Vertical vis 6+m	339	0	315	0	0	0	264	0	140	9
Oct 12	Excellent	45 mm rain - Oct. 3 – 8 Water level normal (0.25m), water clear. Horizontal visibility 30m, Vertical vis 4m	359	0	480	1	0	0	2954	87	37	47
Oct 31	Excellent	435 mm rain - Oct. 12 – 31 Water level normal (0.56m), water clear. Horizontal visibility 20m, Vertical vis 4+m	317	10	848	0	0	0	3149	1152	2	0
Nov 17	Excellent	684 mm rain - Nov. 1 – 17 Water level above normal (0.91m), water clear. Horizontal visibility 20m, Vertical vis 5m	32	39	753	4	0	0	38	36	4	0
		Raw PL+D	436		848		3		4,301		187	
		Exp PL+D	484		942		3		4,779		208	

Table 32-2. Survey life (SL), adult escapement estimate and rational how the method was applied. Escapement estimates use the OE described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Sp.	Survey Life	First Zero	Last Zero	Annual escapement estimate	Analytical method	Data quality level
SK	45 (30-60)	Sep 1	Nov 15	561 (420-841)	Expanded Area under the Curve	2
CO	35 (30-40)	Sep 1	Dec 1	1,370 (1,199-1,599)	Expanded Area under the Curve	2
PK	NA			3	Expanded Peak Live + Dead	2
CM	15 (10-20)	Sep 1	Nov 25	7,851 (5,888-11,776)	Expanded Area under the Curve	2
CN	20 (15-25)	Sep 1	Nov 25	258 (207-345)	Expanded Area under the Curve	2

Escapement Commentary:

SK return: Above the 12 year average (~350).

Tahsis Sockeye life history appears to parallel that of the Leiner stock. Historical swim counts have shown that Sockeye adults are present in their respective streams before stock assessment programs begin in September. Tahsis Sockeye are already present between Marker 10 and Marker 8 by the first week of September unless dewatered habitat impedes migration. Like the Leiner stock, these fish are already displaying some variation of spawning colours by early in September.

Over the last 6 years, the peak Sockeye count in the Tahsis has varied from a low of 110 fish in 2014 to a high of 720 in 2011. In 2016, the peak count of 436 adults was recorded on September 7, the first swim of the season. Over the succeeding 6 surveys this tally remained relatively constant until spawning in early November when the numbers declined. We saw no indication that fresh run, bright Sockeye were entering the river after September 7.

The date of the peak count in 2016 is about a month earlier than 4 of the last 6 years of swim data. This may be explained by the unusually high water conditions throughout September and October, which encouraged most of the run to enter the Tahsis early while migration conditions were optimum.

CO return: Similar to the 12 year average (~1450)

There are no major barriers to coho migration in the Tahsis. Adults move into the river, usually on periodic flow spikes, and migrate throughout the drainage. For this reason it is not uncommon to have counts that fluctuate during the season, as early counted fish moved upstream out of the index section.

In 2016, about 250 Coho entered the Tahsis on the early September flow spike. Over the next 3 surveys counts fluctuated up and down as early fish moved upstream past the index site and new immigrants moved up river. This is consistent with migration patterns observed in 5 of the last 6 years. In 2012, the run was delayed until late October due to extreme low water conditions and dewatered channel habitat.

By early October Coho numbers started to climb steadily eventually reaching the peak count of 848 fish by October 31. We estimated that this number was comprised of 50% new, bright fish mixed in with dusky or semi bright fish. The 2016 peak count falls midway between peak tallies recorded since 2011 (375 - 1380).

The Coho jack count in the Tahsis in 2016 was 39%. This number is much less than the 63% recorded in 2015 but more than 3 times the level recorded for 2013 and 2014 at 13% and 9% respectively.

PK return: Similar to the 12 year average (3)

The Pink salmon run in the Tahsis is a remnant population. Peak counts over the last decade have been in the single digits with most observations consisting of post spawning males. In 2016 we observed 3 adults on September 7 and a single sighting a week later. In 2015 the peak count was marginally higher at 4 fish. These numbers are likely conservative but emphasize the Pink salmon escapement to this system is extremely small.

CM return: Similar to the 12 year average (~6400)

In 2016, the Chum run started slowly with only a handful of adults in the river by mid-September. The number bumped up to 2-300 fish by early October before spiking to around 2954 by October 12 attracted by the high flows and heavy rains of mid-October. This count remained relatively static over the next 2 weeks eventually rising to 3149 fish by October 31. This year's peak count is comparable to numbers recorded in 2012 and 2014 but 25% less than the 2015 count. The timing of the peak live count for Chum in 2016 falls within a week of peak counts recorded over the last 5 years of survey data.

The distribution of Chum salmon in 2016 was similar to other years with the highest concentrations holding and spawning in the lower half of the index section. In 2015, a strong Chum return in association with ideal migration flows saw about 16% of the run upstream of Marker 6. In 2016, under ideal flow conditions only 263 Chum or 8% of the peak count was upstream of this point. This suggests migration flows alone may not be the only factor determining Chum distribution in the Leiner.

Marker 0 at the Perry Bridge lies just upstream of the high tide mark on the Tahsis River. The 1400m downstream of this point are intertidal. Adults holding in this zone are not included in the stock assessment tally. In some years, a significant portion of the run hold and spawn in the freshwater lens of this zone. On October 25, 2015 we observed several thousand Chum actively spawning downstream of Marker 0. Shore observations of the intertidal zone in mid-October 2016 showed similar numbers of spawning Chum.

CN return: Similar to the 12 year average (~325)

The timing of Chinook migration in the Tahsis River is similar to the Leiner stock. In 2016, heavy rains and rising water levels in early September provided the flow conditions necessary for Chinook to transit the shallow riffle habitat at Marker 0 and enter the river early. On September 7, 84 bright Chinook were observed holding in several large groups in the lower river. The count remained relatively unchanged until mid-September rains drew in the backbone of the run. On September 23, the peak count of 186 adults was recorded. This compares to the 2015 peak count of 230 adults on September 27. The 2016 count of 184 fish is about average when compared with peak tallies recorded since 2011 (74 - 470).

There are no physical barriers to Chinook migration in the Tahsis. Adults migrate throughout the 5 km of the index section with a few fish likely moving beyond Marker 10 into the headwaters.

The 2016, the Chinook jack count in the Tahsis was about 16%, which is less than half the 37%, recorded in 2015.

32.3. Spawner Distribution

Run Timing:

Table 32-3.The run timing for the survey year by species. 'Obs.' refers to snorkel survey date when species or activity was encountered. 'Prob.' refers to probability of occurrence using expert opinion

Species	Arrival in Stream		Date of Spawning					
			Start		Peak		End	
	Obs.	Prob.	Obs.	Prob.	Obs.	Prob.	Obs.	Prob.
Sockeye	07-Sep	Jul-Sep	12-Oct	12-Oct	31-Oct	31-Oct	17-Nov	20-Nov
Coho	07-Sep	01-Sep	17-Oct	17-Oct	No data		No data	
Pink	07-Sep	01-Sep	07-Sep	01-Sep	No data		No data	
Chum	07-Sep	01-Sep	23-Sep	23-Sep	31-Oct	25-Oct	17-Nov	10-Nov
Chinook	07-Sep	01-Sep	23-Sep	20-Sep	No data	25-Sep	12-Oct	05-Oct

Spatial distribution:

Table 32-4. The survey sections used by spawners per species in order of importance for Tahsis River, 2015.

Species	Survey Section(s) used for spawning
Sockeye	Marker 8/7 - mid section run; Marker 10/9 - Beaver pond pool d/s to Marker 9; Marker 7/6 - 100m long glide ending at Marker 6 sign; Marker 5/4 - riffle site below long glide; Marker 4/3 - perimeter site of long glide
Coho	Marker 10 to Marker 4; upstream of Marker 10
Pink	Marker 4 to Marker 2 - primarily shallow riffle habitat; Marker 6/5 – perimeter sites along glide habitat

Chum	Marker 6 to Marker 0 - riffle and run habitat; Marker 0 d/s 600m - intertidal zone at low tide; Marker 10 to Marker 6
Chinook	Marker 7 to Marker 4 - primarily run habitat; Marker 10 to Marker 7 – riffle and run habitat; Marker 4/3 - riffle and run habitat

Spawning Distribution Commentary:

Sockeye Spawning:

Sockeye spawning on the Tahsis occurs throughout the index section. Until recently, the preferred area was consistently upstream of Marker 5 with heaviest concentrations between Marker 10 and Marker 9. Since 2012 the favoured area has shifted to the 500m below Marker 8. This is likely due to access issues created by extreme drought conditions and dewatered habitat above Marker 8.

The timing of Sockeye spawning in 2016 followed the same general pattern as previous years. The first observation of fish pairing up and spawning was October 12; with peak spawning occurring around October 31 to coincide with heavy rains of the previous 10 days. High water late in the season is a major factor in driving peak spawning activity. Sockeye spawning likely ended around mid-November since most of the 32 adults observed on November 18 were males holding over completed redds.

Coho Spawning:

Coho spawn throughout the drainage. Key spawning areas are upstream of Marker 4 but preferred sites within the index section are between Marker 6 and Marker 10 in pool tailouts and edge habitat below log debris. It is unknown what proportion of the coho run migrate and spawn upstream of the index section but it is probably substantial.

On November 17, 2016, we observed a few Coho just beginning to pair up and spawn. Heavy rains throughout November precluded further surveys but it is likely that spawning continued through the month ending in early to mid-December.

Pink Spawning:

The 4 Pink salmon observed in 2016 spawned downstream of Marker 6 prior to September 16. It is possible that a few pairs spawned during the August 29 to September 5 flow pulse, died and were washed from the system prior to the first survey on September 7.

It is unclear why so few Pink salmon return to the Tahsis River, as spawning habitat is not limiting for this species. The lower 2 km has abundant gravel bars and numerous low gradient riffles and runs to accommodate several thousand individuals yet few adults are observed annually.

Chum Spawning:

Chum spawn throughout the index section. In most years, most spawning activity takes place in the lower 3 km (Marker 6 – Marker 0). This year was no different with 92% of the peak count spawning downstream of Marker 6.

The spawning cycle in 2016 was consistent with previous years. The first observation of Chum pairing up and spawning was on September 23. Activity remained relatively static over the next 3 weeks until high flows brought in the peak of the run. By October 12 spawning was in full swing eventually peaking on or about October 31. Heavy spawning likely continued through early November before declining thereafter. On November 17, the final survey, the count had dropped sharply to 38 adults with about a third still on redds.

Chinook Spawning

To a large extent, Tahsis Chinook hold and spawn in the same areas every year. Exceptions to this pattern can occur during an exceptionally wet or exceptionally dry September. In wet years a larger proportion of adults will move to upstream holding areas and eventually spawn above Marker 6 whereas in a dry September the reverse is true. In September 2015, an average rainfall month, all Chinook spawning occurred upstream of Marker 3 (Km 2.5) with 40% above Marker 6 (Km 3). By comparison, the extremely wet conditions of September 2016, found that 67% of the Chinook spawned upstream of Marker 6.

In 2016, the Chinook spawning cycle began around the third week in September. We estimated about 3% of the 186 adults were paired and spawning of this date. Spawning activity likely accelerated during several rain events after September 19 eventually peaking around the last week of September. By October 12, survey results showed a 80% drop in the live count, suggesting spawning ended a week earlier.

32.4. Environmental Conditions

Weather Summary: The weather in the Nootka Sound area during the late summer and fall of 2016 was extremely wet. The first major storm of the fall began August 29. By November 17 (last Tahsis R survey) there were 64 days of rain and 1437 mm of rain recorded in the Nootka area (Conuma Hydromet data). Heavy rains continued through November 30 for a 3-month total of 1646 mm of rain.

Physical Characteristics Update: The Tahsis watershed was heavily logged starting in the 1950s. Regrowth is mostly Red Alder and willow with conifer species starting to appear in localized areas away from the stream bank. Although there hasn't been any active logging for 30 years, the stream channel remains unstable. The active channel still migrates across the valley bottom from time to time in response to flood events. During late summer and early fall, sections of the wetted channel often flow subsurface leaving large sections of the channel dry.

The Tahsis River between Km 5 and Km 4 (Marker 10 to Marker 8) dewatered for several weeks between September and October in 2012, 2013, 2014 and 2015. Dewatering did not occur in 2016 because of the unusually wet weather experienced over the fall period.

There are 6 areas within the 5 km index section where active channel erosion is taking place. Each has been photographed and the UTM location recorded. For a description of these areas and the list of photographs refer to the .xls spreadsheet entitled Disturbance sites and GPS coordinates for Area 25, 2016.

32.5. Update to Stream Survey Protocols

Current Assessment Method: Currently, escapement estimates are obtained by a 2-person crew snorkelling the river from Km 5 to the Perry Bridge. There are 10 – 500m sections with each section identified by a red triangle with the corresponding section number. Marker 10 begins at Km 5 and Marker 0 ends at the Perry Bridge. The UTM location of each marker sign is recorded such that missing signs can be replaced easily.

Surveys take about 4-5 hours to complete including rest breaks

Deviations from current assessment protocols: None. Methods consistent with previous years.

Access Updates: Access to Marker 10 remains the same as described in the stream narrative. Crews basically walk the 5 km from the Perry Bridge at Marker 0 to Marker 10 at the top of the index section. The hike usually takes about 75 minutes but can take longer at higher flows since the crew must walk up the channel for most of the route.

Safety Update: There are several safety issues facing swimmers on the Tahsis R. Two concern in-stream hazards and one that is wildlife related:

1. In 2015 a full channel logjam formed at Marker 2. This jam has been added to in 2016 and is impossible to snorkel through at moderate flows. Swimmers must be walked around this debris jam.
2. There are 2 strainers (log with branches submerged cross channel) that can have a high entanglement potential. One is located between Marker 2 and Marker 1 and other on an S-bend between Marker 6 and Marker 5. At low flows these logs are clearly visible and easily avoided but not so easy to see while swimming at moderate flows. Consider this site a hazard at moderate to high flow levels. These areas are often associated with large groups of Coho and Chum and need to be surveyed.
3. There is the potential for bear conflicts when water levels are low and salmon are in the riffles spawning. There were no issues with bears in 2015 and 2016 but in 2012 and 2013 there were several and all occurred between Marker 10 and Marker 9. This 500m, right bank channel connects the beaver dam pool (Marker 10) to the confluence with the left bank channel at Marker 9. In 2012 and 2013 there were several run-ins with belligerent bruins that were in the channel feeding on spawners. On two occasions the bears refused to move out of the channel and we had to start the survey at that point. Bear spray is required equipment.

32.6. Enhancement

Brood Removal: 111 Chinook were taken for brood

Planned Release Numbers and Strategy:

Stock		Adults				Juveniles		
	Egg Target	Brood Target		Brood Collected		Release Target	Release Stage	Release Site
		Male	Female	Male	Female			
Tahsis River Chinook	160,000	40	40	31	74	150,000	Seapen Smolt	Tahsis Inlet
Leiner River Chinook	160,000	40	40	66	77	150,000	Seapen Smolt	Tahsis Inlet

Other enhancement and restoration activities:

During the summer 2015, volunteers from the Tahsis Enhancement Society removed several dump truck loads of gravel from the shallow pool below the Perry Bridge. This was to deepen the habitat to enhance Chinook and Chum early season holding habitat until fall rains provided suitable flows for adults to move up river. Observations of this pool during the surveys of 2016 indicated the pool had completely filled in. Few Chinook seemed to use the pool although a few hundred Chum still hold and spawn here.

32.7. Biosamples

Age Distribution (n=32): 16% 3_1, 72% 4_1, 12% 5_1

Hatchery Contribution (n=40): 72.5% Hatchery [52.5% Leiner, 12.5% Conuma, 7.5% Gold], 27.5% unmarked

32.8. Concerns and Comments

1. All marker signs were replaced and UTM coordinates recorded. On the last survey of the season, Marker #1 was missing, lost due to a major high water the week before. This sign will need to be replaced next year.
2. A GPS track was also completed tracing the complete survey route.
3. The staff gauge at Marker 0 (Perry bridge) is damaged and needs to be re-set.
4. There are a lot of Chum spawning below the survey area.
5. The whole system is eroded.

33. CONUMA RIVER

33.1. Stream Summary

The Conuma River flows into Moutcha Bay at the head of Tlupana Inlet in Nootka Sound. The Conuma Hatchery, located about 2.5 km upstream from the mouth, has been in operation since the 1980s. The hatchery currently rears Chinook, Chum and Coho. There has been extensive industrial forestry and road building in the watershed. The system is extremely flashy and is swimmable and clear within a few hours of the end of major rain events. It has good visibility, though not quite as good as Tahsis. Flow is more than Tahsis but less than the Burman.

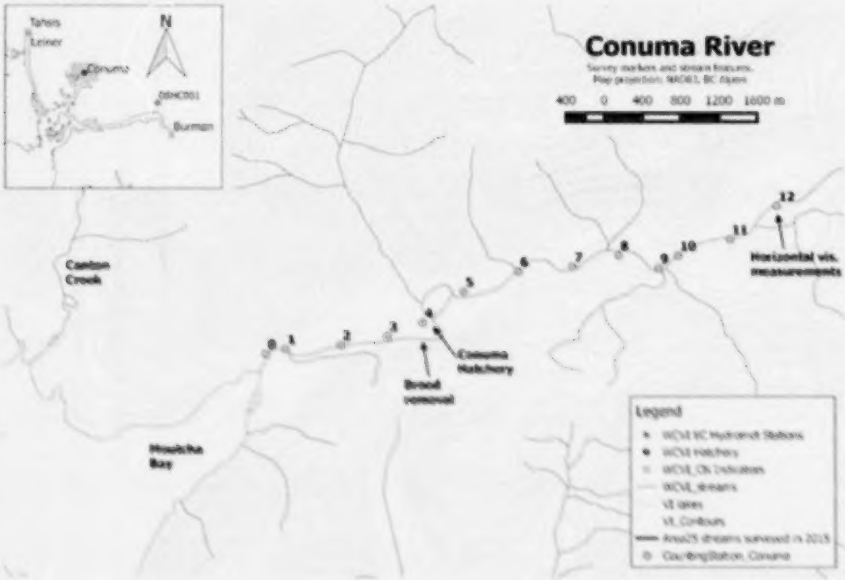

Tahsis
Leiner
Conuma
N
08HC001
Burman
Conuma River
400 0 400 800 1200 1600 m
Canton Creek
Moutcha Bay
0
1
2
3
4
5
6
7
8
9
10
11
12
Brood removal
Conuma Hatchery
Horizontal vis. measurements
Legend
WCVI_streams
VI lakes
VI_Contours
Area25 streams surveyed in 2015
CountingStation_Conuma

Figure 33-1. Conuma River counting stations. Map inset show locations of other systems that are regularly surveyed in the area as well as the location of the nearby Environment Canada hydromet stations on the Gold River (08HC001). Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia.

33.2. Survey results and escapement estimate

Survey Crew: Al Eden and Associates (Al Eden, Shawn Hay, Mike Lough)
Stock Assessment Biologist: Diana McHugh

In 2016, the Conuma River was snorkelled 5 times between September 5 and October 11 with an average survey frequency of 8 days (Table 33-1). A 6th survey was planned but consecutive days of rain after October 12 kept the water conditions in the Conuma high and coloured. The spacing of rain events during September and early October allowed crews to schedule swims at timely intervals and thereby closely track Chinook and Chum throughout the migration window; we consider the data to be reliable.

Individual Survey Data:

Table 33-1. Unexpanded live and dead counts by species for each survey.

Date	OE cat.	Comments	SK		CO		PK		CM		CN	
			Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
119mm rain - August 29 to September 1												
Sep 5	Excellent	Staff gauge 0.524m. Horizontal vis 15m, vertical vis 6m. Water level normal	51	0	47	0	0	0	25	0	17189	0
26mm rain – September 5 – 10												
Sep 15	Excellent	Staff gauge 0.459m. Horizontal vis 15m, vertical vis 4m. Water level below normal	30	0	97	0	0	0	119	0	10708	191
96mm rain – September 16 – 19												
Sep 22	Good	Staff gauge 0.55m. Horizontal vis 20m, vertical vis 6+m. Water level below normal	19	0	624	0	0	0	872	0	12126	1595
28mm rain – September 22 – 26												
Sep 30	Good	Staff gauge 0.50m. Horizontal vis 23m, vertical vis 6+m. Water level normal	14	0	443	0	2	0	866	5	4895	2547
48mm rain – October 1 – 8												
Oct 11	Excellent	Staff gauge 0.50m. Horizontal vis 14.7m, vertical vis 4+m. Water level normal	38	0	946	0	0	0	7260	501	411	335
		Raw PL+D	51		946		2		7,761		17,189	
		Exp PL+D	57		1,051		2		8,623		19,099	

Comments: Hatchery staff noted fish in the system Aug 28; Sept 8 19,500 CN obs from the campsite to estuary pool; Sept 21 17,347 observed by drone marker 11 to 1.

Table 33-2. Survey life (SL), adult escapement estimate and rational how the method was applied. Escapement estimates use the OE described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Sp.	Survey Life	First Zero	Last Zero	Annual escapement estimate	Analytical method	Data quality level
SK	30 (25-35)	Sept 1	Nov 15	67 (57-80)	AUC	2
CO	35 (30-40)	Sept 1	Dec 1	1,288 (1,127-1,502)	AUC	2
PK				Adults Present		2
CM	15 (10-20)	Sept 1	Nov 15	13,628 (10,221-20,441) + 2,808 brood removals = 16,436 total adult return	AUC	2
CN	17.5 (15-20)	Aug 20	Nov 15	30,387 (26,589-35,452) + 6,692 removals = 37,079 total adult return	AUC	2

Escapement Commentary:

Sockeye Return:
Below the 12 year average (~180)

In 2016, the peak live count of 51 Sockeye was made on September 5 and is consistent with numbers observed in 2014 and 2015. The count probably underestimates actual abundance due to the difficulty in identifying this stock among the large numbers of Chinook and Chum holding and spawning in the river.

Conuma Sockeye are normally observed throughout the 6 kilometers of the index section. In 2016, all Sockeye observations were between Marker 4 and Marker 12 with 90% of the count upstream of Marker 7.

Coho Return:
Below the 12 year average (~2400)

The early season tally for Coho was very low as reflected by the low count of 97 fish recorded September 15. This count represents an 80% decline from mid-September peak counts recorded for 2013 and 2015 (no data for 2014). The seriousness of the low count was underscored by prompt action by DFO managers to cut by half the recreational kill fishery from 2 fish to 1.

The peak count of Coho this year was 946 fish on October 11. This count, although much improved from mid-September numbers is still 40 to 80% less than peak counts recorded since 2011. It should be noted that Coho migration extends into December so these estimates should be considered conservative.

Similar to previous year surveys, the 2016 Coho count fluctuated during the season. On September 22 for example, 624 Coho were counted, a week later the number dropped to 443 fish before rebounding to the peak count of October 11. The variability in the count can be explained to some degree to the movement of Coho in and out of the index section. The anadromous barrier in the Conuma is 500m upstream of Marker 12 in the lower canyon (Km 6.5). An unknown number of Coho move beyond Marker 12 into the lower canyon habitat where they hold in deep pools until spawning. This was confirmed in 2014 when the crew swam upstream into the canyon and observed several large groups of Coho milling about, well upstream of Marker 12.

The Coho jack count in 2016 was about 17% of the adult count. This is identical to the jack percentage recorded for 2015. Comparison to data prior to 2015 is not possible due to infrequent surveys.

Pink Return:
The 2016 Pink salmon count in the Conuma was 2 fish. Peak counts have been consistently less than 5 fish since 2011 suggesting a viable run may not exist. A review of historic Pink escapement in the Conuma showed that low returns are a regular occurrence. Since 1993, there were 9 zero counts and 9 counts less than 10 fish. The highest returns occurred during a 4-year period between 1996 and 2000 when escapement approached 70 adults.

It is possible that these low Pink counts may not be representative of the true strength of this stock. Pink salmon run timing overlaps with early entry Chinook and Chum salmon. The large escapements of these hatchery stocks make the identification and enumeration of less abundant species difficult.

Chum Return:
Above the 12 year average (~9000)

There was a relatively modest Chum return to the Conuma in 2016. Despite ideal migration flows Chum entry into the Conuma began slowly with only 119 adults counted by mid-September, rising to about 900 fish by months end. The peak count of 7260 Chum was recorded on October 11 following 8 days of rain. By comparison, the 2016 peak count is similar to the timing of peak counts recorded in 2013 and 2014 but 2 weeks later than 2015.

Chum salmon migrate throughout the index section. The distribution of Chum salmon in 2016 was similar to other years with the largest proportion of the run holding and spawning downstream of Marker 4 (hatchery). This heavy concentration in the lower river is expected since Chum returns are primarily derived from hatchery production. On October 11, 6576 adults or 91% of the total count was holding in the lower 2 kilometers of the river.

Chinook Return:
Above the 12 year average (~22,000)

Chinook adults migrate throughout the 6-km index section. The majority of adults remain downstream of Marker 12 although in some years a small number have been observed holding in the deep pools of the lower canyon where they remain before dropping back downstream to spawn later in September.

In 2016, Conuma Chinook, like other Nootka area Chinook streams, entered the river early taking advantage of the 4 days of rain and high water in early September. The peak count of 17189 Chinook occurred on September 5, the first survey of the season. On September 15, 10 days later, the count dropped 30% to 10798 only to rise to 12126 by September 22. The early peak count followed by a sharp decline differs from patterns observed in other years. For example, the timing and magnitude of the peak count in 2015 followed a more typical bell curve distribution where migrants entered steadily to a mid-September peak before declining after spawning. The 2016 peak count was almost 10 days earlier than 2015.

The distribution of Chinook in the Conuma is similar to Chum, with a large percentage of the run comprised of hatchery origin adults that are homing to areas adjacent to the hatchery. In 2016, almost the entire peak count was observed downstream of Marker 6 (Km 3) with about 90% (15460) below Marker 4 (hatchery).

The 2016, the Chinook jack count in the Conuma was a relatively low 5%. This is similar to the 4% recorded for 2015. This number should be considered a underestimate however, due to the difficulty in identifying jacks among the extremely large, often milling groups of adult Chinook.

33.3. Spawner Distribution

Run Timing:

Table 33-3. The run timing for the survey year by species. 'Obs.' refers to snorkel survey date when species or activity was encountered. 'Prob.' refers to probability of occurrence using expert opinion

Species	Arrival in Stream		Date of Spawning					
			Start		Peak		End	
	Obs.	Prob.	Obs.	Prob.	Obs.	Prob.	Obs.	Prob.
Sockeye	05-Sep	01-Sep	No data		No data		No data	
Coho	05-Sep	01-Sep	No data		No data		No data	
Pink	30-Sep	16-Sep	No data		No data		No data	
Chum	05-Sep	01-Sep	22-Sep	18-Sep	11-Oct	08-Oct	No data	
Chinook	05-Sep	01-Sep	05-Sep	05-Sep	22-Sep	18-Sep	11-Oct	11-Oct

Spatial distribution:

Table 33-4. The survey sections used by spawners per species in order of importance for Conuma River, 2015

Species	Survey Section(s) used for spawning
Sockeye	Marker 12 to Marker 8 – canyon pool to hydro run; Marker 4/3 – Leagh Cr confluence to Bill's run
Coho	Marker 12 to Marker 6 – riffles, pool tail outs and perimeter sites in runs; Marker 6/5 to Marker 3 – tail out of hydro pool at road corner to tail out of Bill's run.
Pink	Marker 6 to Marker 0 – mainly shallow riffle habitat
Chum	Marker 5 to Marker 0 – pool tail outs, all riffle and run habitat; Marker 8 to Marker 5 – riffles and perimeter sites in runs; Marker 12 to Marker 10 - riffles and perimeter sites in runs.
Chinook	Marker 5 to Marker 0 – pool tail outs, all riffle and run habitat; Marker 8 to Marker 5 – riffles and perimeter sites in runs; Marker 12 to Marker 10 - riffles and perimeter sites in runs.

Spawning Distribution Commentary:

Sockeye Spawning:

Sockeye spawning was not observed in 2016 due to high water conditions after October 12. The location of spawning in 2016 likely shifted to riffle and run habitats above Marker 8 since this is where the majority of adults were observed in the last survey on October 11.

Coho Spawning:

Coho spawn throughout the 6 kilometers of the index section. Key spawning areas are upstream of Marker 6 but some late entry Coho prefer to spawn in the lower river, usually in the 1000m upstream of the hatchery. It is unknown what proportion of the Coho run migrate and spawn upstream of the index section in the pool tail outs of the lower canyon.

Coho spawning was not observed in 2016 due to extreme high water conditions after October 12

Pink Spawning:

In 2016, the 2 Pink salmon observed were single sightings in Marker 6/5 and Marker 1/0. Both fish were coloured males that appeared to be post spawners.

Factors impacting Pink spawning in the Conuma are likely related to the large number of Chinook and Chum salmon spawning in the lower river. In most years, every square meter of gravel in the lower 3 kilometers of the Conuma is excavated numerous times by successive waves of larger salmon such that the survival of Pink salmon eggs would be extremely low.

Chum Spawning
Chum spawn throughout the index section. In most years, spawning activity takes place in the lower 2 km (Marker 4 – Marker 0). This year was no different with 91% of the October 11 peak count spawning downstream of Marker 4.

The spawning cycle in 2016 was consistent with previous years. The first observation of Chum spawning was on September 22 when 16% of the 872 adults observed were paired up and actively digging redds. Judging by the numerous redds we saw during the September 22 survey, It is likely that spawning started around September 18 when rising water levels from 3 days of rain provided ideal spawning conditions. Spawning activity remained steady at about 17-18% of the adult count reaching a peak on or about October 11. Heavy rains and poor swim conditions after this date prevented further surveys but it is likely that spawning continued throughout October.

Chinook Spawning:
Chinook typically spawn throughout the accessible reach of the Conuma although they prefer the wide gravel riffles in the lower river. The distribution of spawners in 2016 was no exception. Due to the influence of hatchery water to returning Chinook, about 70-80% of the run spawns within 1500 m above and below Marker 4.

Chinook spawning was first noted on September 5 when several dozen redds and about 2% of 17,189 adults were observed paired up on redds. Over the next 2 surveys, the number of active spawners increased steadily, reaching 43% of the count by September 22. Coincident with the increased spawning activity was a rising dead count and kelt observations; this suggests peak Chinook spawning likely took place between September 18 and 25 before tailing off, ending around mid-October.

In some years Chinook and Chum redd dewatering can be a serious concern on the lower Conuma. This situation was observed in both 2012 and 2015. In 2012, an extremely dry fall when the first major rain storm occurred mid-October, Chum salmon were the most affected. In 2015, when several heavy rain events occurred during mid-September and early October, Chinook salmon were impacted. In 2016, the incidence of dewatered redds did not appear to be a factor as frequent rain events over the fall kept the channel well wetted during the Chum and Chinook spawning period.

33.4. Environmental Conditions

Weather Summary:

The weather in the Nootka Sound area during the late summer and fall 2016 was extremely wet. The first major storm of the fall began August 29. By October 11 (last Conuma R survey date) there were 24 days of rain and 317mm of rain recorded (Conuma Hydromet data). Heavy rains continued from October 12 for 47 of the next 48 days for a total of 1328 mm of rain. The resultant high flows prevented any further swim surveys on the Conuma for the remainder of the season.

Physical Characteristics Update:
The river upstream of Marker 8 is relatively stable; there was little evidence of recent bank slumping noted this year. Below this point the channel becomes progressively wider with large,

elevated gravel bars common throughout the lower river. Near Km 3.5, on the right bank mid-way through the S-bend (Marker 8/7) the river is actively side cutting into the roadbed. This site was noted in 2015 as well.

33.5. Update to Stream Survey Protocols

Current assessment method:

The index section is 6 kilometers long and is broken up into 12 - 500m marks. Standard swim methodology is to spot a vehicle on the hatchery access road near Marker 0. Drive a second vehicle or get dropped off near an unnamed creek where it crosses Head Bay Road about 1.6-road km west of the Conuma Bridge. In August 2016, Conuma Hatchery staff improved access to Marker 12 by cutting an ATV road from a pull off on the Head Bay Road about 50m west of the unnamed creek to the pool at Marker 12. This was to install the new real-time hydromet station as well as to allow better access to salmon brood netting sites in the upper river. Swim crews can now access the Marker 12 start point by hiking along the ATV trail to the river, a distance of about 300m.

Depending on flows, visibility and fish numbers, the survey generally takes about 6-7 hours including rest breaks to complete.

Deviations from current assessment protocols:

Methods consistent with previous years.

Access Updates:

Access to Marker 12 has improved. See Current Assessment Methods for details.

Safety Update:

There are no safety issues outside the normal in-stream hazards present on the Conuma River.

33.6. Enhancement

Brood Removal:

75 coho, 2,808 chum, 6,844 chinook (includes ESSR chinook fishery)

Other enhancement and restoration activities:

Currently none

33.7. Biosamples

Age Distribution (n=271): 2% 2_1, 22% 3_1, 65% 4_1, 11% 5_1

Hatchery Contribution (n=297): 98% Hatchery [97% Conuma, 0.7%Tlupana/Sucwoa, 0.3% Burman], 2% unmarked

33.8. Concerns and Comments

Ongoing issue identified last year of enumerating large groups of Chinook and Chum salmon using snorkel surveys. Discussions and subsequent application of new techniques to reduce the error in counting fish in large groups is ongoing.

34. CANTON RIVER

34.1. Stream Summary

Canton Creek flows south into Head Bay near the end of Tlupana Inlet in Nootka Sound. The system is remote but accessible by road from Gold River. The mainstem is 12.3 km in length and fed by two main headwater tributaries. Water clarity is generally good but becomes turbid after rain events and can take 48 to 72 hours to clear. There is a barrier to fish migration under some flows at 4.8 km upstream from the mouth.

The standard survey is from markers 7 to 0, with the start about 3.5 km upstream from the Head Bay Road bridge.

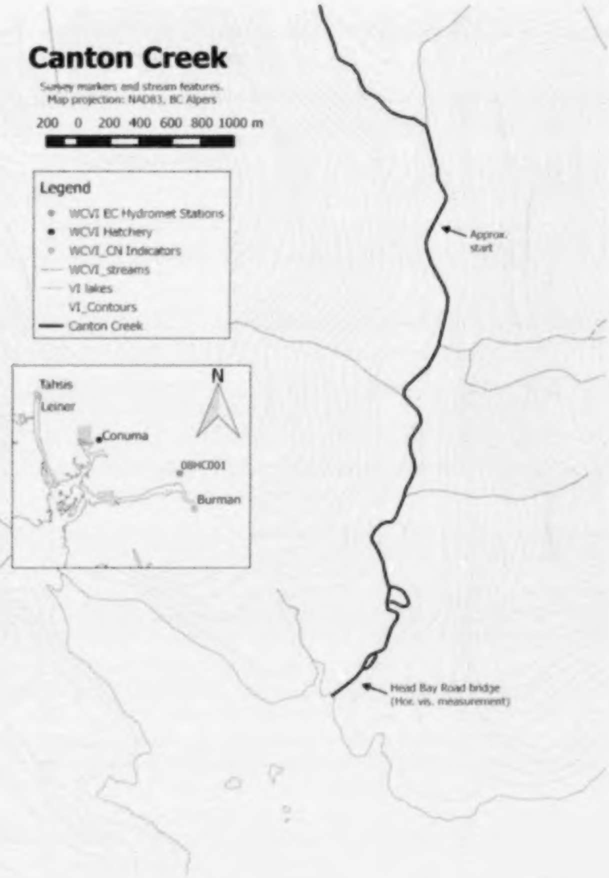

Canton Creek
Survey markers and stream features.
Map projection: NAD83, BC Albers
200 0 200 400 600 800 1000 m
Legend
● WCVI EC Hydromet Stations
● WCVI Hatchery
● WCVI_CN Indicators
WCVI_streams
VI lakes
VI_Contours
Canton Creek
Tahsis
Leiner
Conuma
08HC001
Burman
N
Approx. start
Head Bay Road bridge (Hor. vis. measurement)

Figure 34-1. Canton River. Map inset shows the locations of other systems that are regularly surveyed in the area as well as the location of the Environment Canada hydromet stations on the Zeballos River near Zeballos (08HE006) and on the Klaskish River near Klaskino Inlet (08HE009). Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia.

34.2. Survey results and escapement estimate

Survey Crew: Al Eden and Associates (S. Hay, G. Horncastle, P. Law, M. Lough)
Stock Assessment Biologist: Diana McHugh

In 2016, the Canton River was snorkelled 5 times between September 8 and October 30 with an average survey frequency of 11 days. The spacing of the rain events during September and October allowed crews to schedule swims at timely intervals and thereby closely track salmon migration throughout the fall season; we consider the data to be reliable.

Individual Survey Data:

Table 34-1. Unexpanded live and dead counts by species for each survey.

Survey #	Date	Sockeye		Coho		Pink		Chum		Chinook	
		Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
134 mm rain - August 29 to September 8											
1	Sep 8	2	0	127	0	0	0	20	0	4124	0
96 mm rain – September 16 – 19											
2	Sep 21	1	0	209	0	0	0	168	0	7576	727
28 mm rain – September 22 – 26											
3	Sep 29	6	0	293	0	0	0	357	0	2272	1733
48mm rain – October 1 – 8											
4	Oct 11	13	0	516	0	0	0	1881	123	189	2683
430 mm rain – October 12 – 29											
5	Oct 30	1	0	585	0	0	0	369	126	2	0
Raw PL+D		13		585		0		2,004		8,303	
Exp PL+D		14		650		0		2,227		9,226	

Comments: Rainfall amounts recorded from the DFO hydromet site on the Conuma River were used as a proxy for all Area 25 streams.

Table 34-2. Observer efficiency rationale. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:
For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%
For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

Date	OE category	Comments
08-Sep-16	Excellent	Water level normal. Horizontal vis 10+m, vertical vis 6+m
21-Sep-16	Excellent	Water level normal. Horizontal vis 15m, vertical vis 6+m
29-Sep-16	Excellent	Water level normal. Horizontal vis 15+m, vertical vis 6+m
11-Oct-16	Excellent	Water level below normal. Horizontal vis 15m, vertical vis 4m
30-Oct-16	Excellent	Water level normal. Horizontal vis 16.4m, vertical vis 3m

Comments:

Table 34-3. Survey life (SL), adult escapement estimate and rational how the method was applied. Escapement estimates use the OE described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Sp.	Survey Life	First Zero	Last Zero	Annual escapement estimate	Analytical method	Data quality level
SK	25 (20-30)	Sep 1	Nov 15	14 (11-17)	Expanded AUC	3
CO	35 (30-40)	Sep 1	Nov 15	782 (684-912)	Expanded AUC	2
PK						
CM	15 (10-20)	Sep 1	Nov 15	3048 (2286-4572)	Expanded AUC	2
CN	17.5 (15-20)	Aug 28	Nov 15	9824 (8596-11461)	Expanded AUC	2

Escapement Commentary:

Sockeye Return:
Less than the 12 year average (~50)

The Canton River has a small riverine Sockeye population. Similar to other Nootka Sound streams, life history information on this stock is limited. Historical data shows that small numbers of Sockeye have been observed in the Canton since 1974. Over the succeeding 42 years, Sockeye have been recorded in the Canton 20 times with peak counts ranging from 2 and 200 fish.

Sockeye migrants appear to enter the Canton River early in the fall likely capitalizing on rising flows brought on by late summer or early fall rain events. In 2011 and 2016, snorkel observations showed Sockeye present in the lower reach of the Canton by the first week of September. Many of these fish were already showing some colour, which suggests they may have been holding off the river mouth for some time before entering the river.

In 2016, the peak count of 13 Sockeye was made on October 11, but it is likely that these fish were present earlier but missed due to their low abundance and the fact there was a large number of Chinook in the river, which made identification of less abundant species difficult. By comparison the peak Sockeye count in 2011 occurred a month earlier on September 11, the first survey of that season. In 2011, a low water year, there were few other species able to enter the river in September because of low flows. The absence of large numbers of Chinook and Chum during the first 2 surveys of 2011 made observing Sockeye an easier task.

The historical record has indicated that Sockeye migrate throughout the 3500m of the index section. In 2016 however, the preferred holding and spawning habitat was below Marker 3, about 1500m upstream of the Head Bay Road bridge.

Coho Return:
Similar to the 12 year average (~800)

Coho migrate beyond the 3500m of the index section. There is a selective barrier to anadromous migration at Km 4.8 of the Canton. A recent technical report indicated that Coho and Steelhead are able to migrate past this barrier when flow conditions are ideal. Swim counts for 2011 and 2016 suggested that the majority of the Coho run remained below this barrier where spawning habitat is more abundant.

Coho enter the Canton River early in September when flows are high enough to allow access past the shallow riffle areas below Marker 1. In 2016, bright Coho moved steadily into the river through September and October capitalizing on numerous flow spikes. The count grew steadily with each successive survey reaching a peak of 585 fish on October 30. This compares favourably with the migration timing for the 2011 surveys when the peak count of 747 adults occurred around October 16.

The movement of Coho in the Canton is dependent on flows. Surveys have shown that when flows are low Coho adults are restricted to the relatively few, deeper runs and pools downstream of Marker 3. With rising flows in October many of these adults move upstream as far as Marker 5. It is unclear how many Coho move beyond this point since it takes place later in the season when flows are high and swim surveys have finished. It should be noted that spawning habitat is limited upstream of Marker 7 for that reason it seems likely that most Coho remain below this point where they eventually spawn.

The jack Coho return in 2016 was relatively strong at about 22%. Coho jacks were not broken out in the 2011 surveys.

Pink Return:
Historically, there was a small population of Pink salmon in the Canton River. Since 1974 there has been little information recorded for this species since surveys during this period were infrequent. There were no Pink salmon observed during the 5 surveys of 2016. In 2011 however, a handful of Pink salmon spawners were observed in the lower river suggesting a remnant population still exists.

Chum Return:
Similar to the 12 year average (~2600)

In 2016, the first observation of bright Chum salmon in the Canton was September 8. These fish likely entered the river during the high flows of the previous week. The number of Chum migrants rose slowly during September before spiking to 1881 fish on October 11 following 8 days of heavy rain. This is consistent with the timing of the live peak count in 2011 when 546 Chum were recorded on October 10.

Chum salmon have been observed throughout the index section but recent observations indicate that few migrate beyond Marker 6. This species preference for the lower river was quite pronounced. In 2016, 98% of the 1881 Chum counted during the mid-October survey were holding in the deep pools and runs downstream of Marker 3 where they eventually spawned.

The Canton Chum run has been enhanced over the years. Since 1999 however, Chum returns have fallen considerably and now represent less than 15% of the average escapement recorded during the hatchery production years prior to 1998. Chum escapement in the Canton appears to closely follow the highs and lows of Conuma Chum returns; this suggests that Canton Chum are primarily Conuma River strays.

Chinook Return:
Above the 12 year average (~1400)

In 2016, Chinook entered the Canton River during the first week of September taking advantage of good migration conditions created by heavy rains. The influx of adults continued over the next 12 days undoubtedly attracted into the river by a second 4-day rain event mid-month. The peak count of 7576 Chinook was tallied on September 21, before tailing off by month's end. By comparison, this year's count was four times larger and a week earlier than the peak count of 1708 Chinook recorded on October 1, 2011.

Chinook are distributed throughout the accessible portion of the Canton. Early in the season these large adults hold primarily in the lower river where there are several deep pools and runs that provide suitable cover. As flows increase later in September, a small percentage of the run moves upstream as the spawning period approaches. Snorkel observations in 2011 and 2016 confirmed that this upper river component is relatively small. In both years, at least 90% of the run remained downstream of Marker 3.

About 8% of the Chinook counted in 2016 were jacks. Chinook jacks were not broken out in the 2011 surveys.

34.3. Spawner Distribution

Run Timing:

Table 34-4. The run timing for the survey year by species. 'Obs.' refers to snorkel survey date when species or activity was encountered. 'Prob.' refers to probability of occurrence using expert opinion

Species	**Arrival in Stream**		**Date of Spawning**					
			Start		**Peak**		**End**	
	Obs.	**Prob.**	**Obs.**	**Prob.**	**Obs.**	**Prob.**	**Obs.**	**Prob.**
Sockeye	08-Sep	01-Sep	No data		No data		No data	
Coho	08-Sep	01-Sep	30-Oct	30-Oct	No data		No data	
Pink	No data							
Chum	08-Sep	01-Sep	21-Sep	21-Sep	11-Oct	11-Oct	30-Oct	05-Nov
Chinook	08-Sep	01-Sep	08-Sep	08-Sep	21-Sep	22-Sep	11-Oct	15-Oct

Spatial distribution:

Table 34-5. The survey sections used by spawners per species in order of importance for Conuma River, 2015

Species	**Survey Section(s) used for spawning**
Sockeye	Marker 3 to Marker 0, Marker 5 to Marker 3
Coho	Marker 5 to Marker 3, Marker 7 to Marker 5, Marker 3 to Marker 1
Pink	Marker 3 to Marker 0
Chum	Marker 3 to Marker 0, Marker 5 to Marker 3
Chinook	Marker 3 to Marker 0, Marker 5 to Marker 3, Marker 7 to Marker 5

Spawning Distribution Commentary:

Sockeye Spawning:

Sockeye spawning was not observed in 2016 but likely took place in gravel habitat adjacent to where adults were observed during the 5 surveys. Preferred spawning areas for this species are primarily downstream of Marker 3 where it overlaps with the spawning habitat of more abundant salmon species like Chum and Chinook.

Coho Spawning:

Coho spawn throughout the index section of the Canton River. Based on adult distribution patterns, the preferred spawning habitat for Coho is between Marker 5 and 3 where several deep pools and runs are adjacent to suitable spawning gravels. Secondarily, areas upstream of Marker 5 are also important but are used when flows are moderately high since cover, in the form of pool habitat is limited in this area.

In 2016, Coho spawning was just beginning on October 30, the last survey of the season. It seems likely that peak spawning occurred throughout November this year facilitated by the heavy rains that fell throughout the month; this provided ideal depths and velocities to a wide variety of normally inaccessible gravel habitat.

Pink Spawning:

There were no Pink salmon observed in the Canton River in 2016 and less than half a dozen in 2011. These low counts match the historical record, as escapement levels have been consistently less than 2 dozen adults since 1997. There is no shortage of suitable Pink salmon spawning habitat in the Canton River so the absence of a viable run may be related to impacts from more numerous Chum and Chinook salmon that use the same gravel sites for spawning. In most years, every square meter of gravel in the lower 1500 meters of the Canton is excavated numerous times by successive waves of larger salmon such that the survival of Pink salmon eggs would be extremely low.

Chum Spawning

Chum salmon spawn in the same general areas of the Canton every year. In 2016, about 98% of the run spawned in the low gradient runs and riffles downstream of Marker 3. In 2016, spawning began around September 21 building slowly through early October. As with other salmonids, spawning is associated with high water events. Such was the case this year when peak spawning occurred around mid October following 8 days of rain.

The timing of Chum migration and spawning in the Canton follows an almost identical pattern as recorded this year for Conuma Chum. This again suggests that both streams share the same population and that Canton Chum are most likely strays from the enhanced Conuma stock.

Chinook Spawning:

Chinook hold and spawn in the same general areas every year. The movement and spawning preference of Chinook closely parallels that of Canton Chum. In both 2011 and 2016 about 98% of the run was observed spawning downstream of Marker 3.

The first evidence of spawning was on September 8 when about 9% of the 4124 adults were paired and actively digging redds. The presence of several dozen redds on this date suggests that spawning had started several days previous. Peak spawning was estimated to be around September 22 and likely continued throughout the last days of September. By mid October spawning was finished based on the sharp decline in the adult count, numerous redds and large dead count.

34.4. Environmental Conditions

Weather Summary:	The weather in the Nootka Sound area during late summer and fall 2016 was extremely wet. The first major storm of the fall began August 29. By October 30 (last Canton R survey) there were 45 days of rain and 751 mm of rain recorded in the Nootka area (Conuma Hydromet data). Heavy rains continued through November 30 for a 3-month total of 1646 mm of rain.
Physical Characteristics Update:	There are 4 disturbance sites documented for 2016. Three refer to actively eroding banks and one describes a new main channel. See accompanying .xls file entitled Area 25 disturbance sites for 2016 with descriptions of these sites and corresponding UTM locations.

34.5. Update to Stream Survey Protocols

Current Assessment Method:	The index section is 3.5 kilometers long and is broken up into 7 - 500m marks. Standard swim methodology is to spot a vehicle on the Canton West Road near Marker 0, adjacent to the Head Bay Road bridge, drive a second vehicle or get dropped off near the trailhead approximately 3 km along the West Road. The flagged trailhead is marked with candy cane flagging tape. The trail traverses down a steep bank for about 20 m to the river channel. The crew hikes upstream for about 300m to Marker 7, which is attached to a 1-m cedar log extending part way across the stream channel. Depending on flows, visibility and fish numbers, the survey generally takes about 4-5 hours, including rest breaks, to complete.
Deviations from current assessment protocols:	Methods consistent with 2011 survey
Access Updates:	No changes to access noted.
Safety Update:	There are no safety issues outside the normal in-stream hazards.

34.6. Enhancement

Brood Removal:
793 Chum

Other enhancement and restoration activities:
Currently none

34.7. Biosamples

34.8. Concerns and Comments

- All missing marker signs were replaced and UTM coordinates recorded.
- A GPS track was also completed tracing the complete survey route.
- Band members from the Mowachaht/Muchalaht First Nation seined the deep pool below Head Bay Road bridge (Marker 0) several times in September to harvest Chinook salmon deemed surplus to Canton River escapement.
- The large number of Chinook milling about in the Head Bay Bridge pool also attracted numerous fishermen several of whom proceeded to foul hook adults.

35. LEINER RIVER

35.1. Stream Summary

The Leiner River flows southwest into the end of Tahsis Inlet in Nootka Sound. The system is fed by small tributaries including the Perry River which enters about 2 km upstream from the mouth (between markers 3 and 4). Spawning salmon are generally found in the lower 2 km of the Leiner which has been divided into 4 survey sections, each 500 m in length (Sockeye and Coho are also found further upstream). The surveys start at survey marker 4 where a bridge crosses the river.

The survey area has a low gradient (<1%) is mainly comprised of riffles, glides and several deep pools. The stream channel is quite stable with the only evidence of bank erosion along the right bank (north bank) below marker 1 bordering Pete's Farm. The deepest pool is about 4 to 5 m and located near the campground near marker 3, however it has been filling in in recent years.

Water clarity in the Leiner is excellent. The river becomes slightly turbid during and after rain events and crews report good visibility 2 to 3 days after a major rain event. Compared to nearby Tahsis River, the Leiner is a slightly larger system and usually takes about a day longer to return to normal after rain events. Unlike the Tahsis River, water level for fish entry is not usually a problem on the Leiner. Even during very low water fish can get in on high tides and hold in pools. The Tahsis Salmon Enhancement Society in Tahsis has been actively carrying out salmon enhancement activities in the Leiner and Tahsis rivers since 1984.

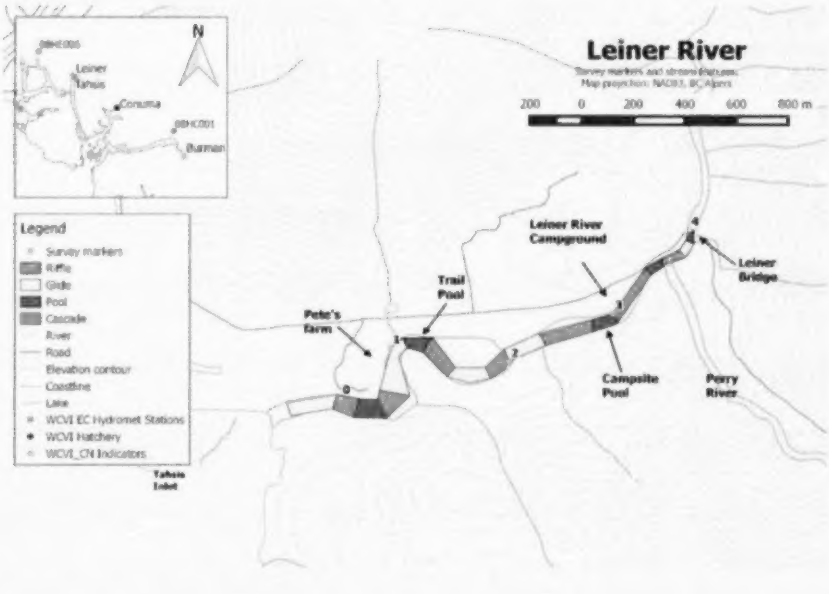

08HE006
Leiner
Tahsis
Conuma
08HC001
Burman
N
Leiner River
Survey markers and stream features
Map projection: NAD83, BC Albers
200
0
200
400
600
800 m
Legend
Survey markers
Riffle
Glide
Pool
Cascade
River
Road
Elevation contour
Coastline
Lake
WCVI EC Hydromet Stations
WCVI Hatchery
WCVI_CN Indicators
Tahsis Inlet
Pete's farm
Trail Pool
Leiner River Campground
Leiner Bridge
Campsite Pool
Perry River
0
1
2
3
4

Figure 35-1. Leiner River habitat units and survey markers. Map inset show locations of other systems that are regularly surveyed in the area as well as the location of the nearby Environment Canada hydromet stations Gold River Below Ucona River (08HC001) and Zeballos River at Zeballos (08HE006). Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. Habitat data were mapped in the field and / or digitized from recent high resolution orthophotographs by M.C. Wright and Associates Ltd.

35.2. Survey results and escapement estimate

Survey Crew: Shawn Hay and Associates (S. Hay, M. Lough, G. Horncastle, P. Law)
Stock Assessment Biologist: D. McHugh

In 2016, the Leiner River was snorkelled 7 times between September 8 and November 18 with an average survey frequency of 10 days (Table 35-1). The spacing of rain events during September, October and November allowed crews to schedule swims at timely intervals and thereby closely track salmon migration throughout the fall season; we consider the data to be reliable.

Individual Survey Data:

Table 35-1. Unexpanded live and dead counts by species for each survey. Rainfall amounts recorded from the DFO hydromet site on the Conuma River were used as a proxy for all Area 25 streams.

Date	OE cat.	Comments	Sockeye		Coho		Pink		Chum		Chinook	
			L	D	L	D	L	D	L	D	L	D
123 mm rain - August 29 to September 5												
Sep 6	excellent	Horizontal vis 20+m, vertical vis 10+m. Water level normal	924	0	409	0	1	0	132	0	1300	2
22 mm rain - September 7 – 10												
Sep 16	good	Horizontal vis 10+m, vertical vis 6+m. Water level normal	1050	0	388	0	1	0	157	2	901	9
96 mm rain - September 16 – 19												
Sep 22	excellent	Horizontal vis 16.5+m, vertical vis 6+m. Water level normal	2258	0	1368	1	0	0	1172	8	604	10
30 mm rain - September 29 – October 1												
Oct 2	excellent	Horizontal vis 16+m, vertical vis 6+m. Water level normal	1721	0	795	2	1	0	1033	243	267	97
45 mm rain - October 3 – 8												
Oct 12	excellent	Horizontal vis 19m, vertical vis 5m. Water level normal	589	0	660	1	0	0	4718	338	60	11
435 mm rain - October 12 – 31												
Nov 1	excellent	Horizontal vis 15m, vertical vis 8+m. Water level normal	668	6	569	0	0	0	828	778	6	0
684 mm rain - November 1 – 17												
Nov 18	excellent	Horizontal vis 16m, vertical vis 5m. Water level normal	39	0	226	0	0	0	17	11	2	0
		Raw PL+D	2,258		1,369		1		5,056		1,302	
		Exp PL+D	2,509		1,521		1		5,618		1,447	

Table 35-2. Survey life (SL), adult escapement estimate and rational how the method was applied. Escapement estimates use the OE described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Sp.	Survey Life	First Zero	Last Zero	Annual escapement estimate	Analytical method	Data quality level
SK	35(30-40)	Aug 20	Dec 1	2,507 (2,194-2,925)	AUC	2
CO	35(30-40)	Sept 1	Dec 1	1,564 (1,369-1,825)	AUC	2
PK				Adults Present		
CM	15 (10-20)	Sept 1	Nov 25	8,018 (6,014-12,027)	AUC	2
CN	20 (15-25)	Sept 1	Nov 25	1,466 (1,173-1,955)	AUC	2

Escapement Commentary:

Sockeye Return:
Above the 12 year average (800).

The life history information on the Leiner River Sockeye stock is limited. Recent peak counts have varied widely ranging from lows of less than 100 fish in 2013 to highs near 1600 in 2011. It is unclear when Sockeye migrants first enter the Leiner River. A review of swim data over the last decade showed that Sockeye adults were present in the Leiner on the first swim of the fall season. Anecdotal reports from knowledgeable volunteers from the Tahsis Community Hatchery report that bright salmon can be seen holding in the Head Bay bridge pool (Marker 4) by late June. In 2016, the first observation of small bright fish in the bridge pool was mid-July. These fish are likely Sockeye.

In 2016, the peak count of 2258 Sockeye was made on September 22 and represents the highest count recorded in the last decade. The count dropped sharply over the next 3 weeks reaching approximately 600 fish by mid-October. This sharp decline is not due to post spawning mortalities since Sockeye don't normally spawn until early November. The fact that few adults were observed upstream of the cascade at Marker 4 suggests a substantial number of Sockeye moved into the Perry. Volunteers from the Tahsis Community Hatchery and local summer Steelhead fisherman reported Sockeye are commonly scene in the Perry as far upstream as the wetland, about 2.5 km above the Leiner confluence. This suggests that the Perry Sockeye population is significant and perhaps larger than the Leiner. This is a data gap that should be investigated further.

The jack Sockeye return in 2016 was relatively strong at about 11%. Sockeye jacks are not normally broken out during surveys so a comparison to previous year data is not possible.

Coho Return:
Above the 12 year average (900).

In 2016, Coho entered the Leiner during the first week in September. This early entry was similar to 2015 and is probably due to these fish responding to optimum migration flows from late August/early September rains. More rain and high water conditions through mid-September drew in more adults, reaching a peak count of 1368 Coho on September 22; this is about 2-3 weeks earlier than peak counts recorded since 2011. Also noted this year was the sharp decline in Coho numbers in subsequent swims. This decrease is likely due to two factors: some early-entry Coho taking advantage of mid-season flow pulses to move into canyon habitat upstream of Marker 7 and out of the survey area; and an unknown number of fish moving from the Leiner into the Perry system. This latter suggestion was confirmed when the swim crew observed about 50 Coho holding in the deep run under the bridge on the lower Perry (350 m u/s of Leiner confluence).

The 2016 peak count of 1368 adults is the highest Coho tally recorded over the last 5 years (213 – 1115).

The jack Coho return in 2016 was 11% of the adult count. This compares to 30% in 2015, 6% jacks in 2014 and 32% in 2013.

Pink Return:
A small number of Pink salmon returned to the Leiner River in 2016. A single adult was observed 3 times through September but all were clearly different fish. The low count of Pink salmon this year is consistent with peak counts recorded since 2011. The run is likely larger than the swim counts indicate and may be due to the inability of surveyors to identify these small fish among larger, more abundant species.

Chum Return:
Above the 12 year average (4200).

The first observation of bright Chum salmon in the Leiner was September 6. These adults probably entered a few days earlier, attracted up river by high flows brought on by heavy, late summer rain.

The first major influx of Chum migrants was on September 22 when 1172 adults were counted. These fish probably entered the Leiner mid-September when 96 mm of rain spiked flows. Subsequent surveys showed Chum numbers remained static over the next 3 weeks before rising quickly to the peak count of 4718 fish on October 12.

The timing of the 2016 peak live count around mid-October is consistent with peak counts recorded for Chum over the last 5 years (2011-2015).

The distribution of Chum salmon in the Leiner is restricted to the lower 2 km. We saw no indication of Chum adults moving past the steep cascade above the Head Bay Road bridge into the lower canyon.

Chinook Return:
Above the 12 year average (420).

In 2016, Leiner Chinook, like other salmon species, responded quickly to the heavy rains and high water conditions of early September and entered the river early.

High water early in September is a key factor in attracting Chinook migrants into the river. A review of recent history shows that the coincidence of early season high water conditions and large Chinook counts has occurred about 9 times since 1995. This occurred again this year. In 2016, the peak Chinook count of 1300 fish occurred on September 6, the first survey of the season. This count is more than 4 times the escapement average for this system and second only to the ~1500 adults recorded in 1974.

The distribution of Chinook in the Leiner is limited primarily to the lower 2 Km of the river. A handful of fish occasionally migrate above the steep cascade at Marker 4 but many years of swim data indicates the preferred habitat is below this point. In 2015 and 2016 we observed less than 2% of the count above Marker 4.

About 9% of the Chinook adults counted in 2016 were jacks. This number falls within the range of 9% - 13% recorded over the last 3 years.

35.3. Spawner Distribution

Run Timing:

Table 35-3. The run timing for the survey year by species. 'Obs.' refers to snorkel survey date when species or activity was encountered. 'Prob.' refers to probability of occurrence using expert opinion

Species	Arrival in Stream		Date of Spawning					
			Start		Peak		End	
	Obs.	Prob.	Obs.	Prob.	Obs.	Prob.	Obs.	Prob.
Sockeye	06-Sep	Jul-Sep	12-Oct	12-Oct	01-Nov	01-Nov	18-Nov	18-Nov
Coho	06-Sep	01-Sep	18-Nov	18-Nov	No data		No data	
Pink	06-Sep	01-Sep	06-Sep	06-Sep	No data		No data	
Chum	06-Sep	01-Sep	16-Sep	16-Sep	12-Oct	12-Oct	18-Nov	18-Nov
Chinook	06-Sep	01-Sep	16-Sep	10-Sep	16-Sep	16-Sep	12-Oct	12-Oct

Spatial distribution:

Table 35-4. The survey sections used by spawners per species in order of importance for Leiner River, 2015.

Species	Survey Section(s) used for spawning
Sockeye	Marker 4/3 - in bridge pool tailout along left bank; Marker 1/0 - Pete's Farm glide, along left bank, often observed spawning amongst spawning Chum. Marker 2/1 – left bank under riparian vegetation just d/s Marker 2 sign.
Coho	Marker 7 to Marker 5/4 - canyon pool tailouts; Marker 4/3 - in bridge pool tailout and Perry/Leiner confluence run; Marker 2/1 - tailout of the Trail Pool; Marker 1/0 - Luke's Hole and Pete's Farm.
Pink	Marker 1/0 - Luke's Hole and Pete's Farm; Marker 2/1 - tailout of the Trail Pool.
Chum	Marker 1/0 - Luke's Hole and Pete's Farm; Marker 2/1 - tailout of the Trail Pool; Marker 4/3 - in bridge pool tailout and Perry/Leiner confluence run.
Chinook	Marker 2/1 - tailout of the Trail Pool; Marker 1/0 - Luke's Hole and Pete's Farm; Marker 4/3 - in bridge pool tailout and Perry/Leiner confluence run.

Spawning Distribution Commentary:

Sockeye Spawning:

Spawning takes place primarily downstream of Marker 4 (Head Bay Road bridge) although in some years a handful of adults will migrate above the steep cascade at Marker 4 to spawn in the pool tailouts of the lower canyon. Adults typically hold in large groups in areas such as the Marker 4 pool and the run below the Perry/Leiner confluence until late October before moving to preferred habitats to spawn. In 2016, Sockeye spawned in the same general areas as in previous years. Key sections were the bridge pool tailout (Marker 4/3) and the shallow gravel edge along the left bank of the long run at Pete's Farm (Marker 1/0).

The first spawning activity was observed on October 12, about 2-3 weeks earlier than previous years and may be due to the unusually wet weather experienced this season. We estimate that peak spawning took place around the end of October as confirmed by the November 1 survey where at least 50% of the 668 adults were paired and actively digging redds. High water conditions delayed the next survey until November 18; by then only a handful of spawners remained and all post spawning mortalities had been washed from the system.

Coho Spawning:
Leiner River Coho spawn primarily upstream of Marker 4 (km 2) in the Leiner canyon. Gravel is abundant throughout the canyon area and Coho have shown that they prefer the pool tailouts and stable edge habitat of this reach to spawn. Coho also spawn in the lower Leiner but suitable habitat is limited to isolated pockets of gravel that are protected from main channel flow. Overall we estimate about 10% of the run spawn downstream of the Head Bay Road bridge (Marker 4).

On November 18, the last survey of the 2016 season, about 90% of the Coho adults observed were holding in large groups in the deep pools of the canyon between Marker 7 and Marker 5. Spawning appeared to be well underway; we estimate about 15% of the count was spawning as of that date. About a half dozen post spawning males were also observed guarding redds.

Pink Spawning:
Pink salmon spawning habitat is limited to a few perimeter sites in the lower Leiner and therefore must compete for space with the more numerous Chum and Sockeye adults.

There were 2 males and 1 female Pink salmon observed this year so it is difficult to estimate when spawning occurred. Based on the condition of these fish it seems likely that spawning started and ended during the first half of September.

Chum Spawning:
In 2016, the timing of the Chum spawning cycle (start, peak and end) appeared to be consistent with previous years. The first observation of spawning activity was on September 16 when a few adults were on redds. By October 2 spawning was in full swing, eventually peaking around mid-October when about 40% of the 4718 adults counted were actively spawning. By month's end, spawning was drawing to a close with only a few late entry adults unspawned by mid-November.

Chum salmon spawn in the same general areas every year. In 2016, about 97% of the run spawned in the low elevation runs and riffles downstream of Marker 2 (km 1) where gravel is abundant. As with other salmonids, spawning is often accelerated by high water. The heavy rains throughout the Chum migration cycle provided optimum spawning flows this year, particularly along shallow perimeter habitat below Marker 1.

Chinook Spawning:
Leiner Chinook hold and spawn in the same general areas every year. In 2016, about 95% of the run preferred spawning in the 1000 m above tidewater (below Marker 2). In some years a few Chinook manage to transit the steep cascade above Marker 4 to spawn in the Leiner canyon. In 2016, we observed 4 Chinook pairs spawning upstream of Marker 4.

On September 6, the first survey of the season, we saw none of the 1300 adults exhibiting any spawning behaviour. Yet 10 days later spawning was clearly well underway and probably started at least a week earlier. We estimated that peak spawning was somewhere around the week of September 10-16 to coincide with moderate to high water levels of mid-September.

This is confirmed by the September 16 survey when we noted a significant decline in the count from the 1300 adults of 10 days earlier suggesting the missing 400 fish had already spawned. On September 16 we observed about 20% of the 901 adults spawning, numerous redds but few fresh morts.

The end of Chinook spawning was thought to be around the first week of October. This is based on observations from the October 12 survey when only 4% of the 60 adults observed were still spawning while the remaining adults were kelts or partial kelts.

35.4. Environmental Conditions

Weather Summary: The weather in the Nootka Sound area during the late summer and fall of 2016 was extremely wet. The first major storm of the fall began August 29. By November 18 (last Leiner R survey) there were 64 days of rain and 1437 mm of rain recorded in the Nootka area (Conuma Hydromet data). Heavy rains continued through November 30 for a 3-month total of 1646 mm of rain.

Physical Characteristics Update: The lower 3.5 km (index section) of the Leiner River is relatively stable; we saw no evidence of recent bank slumping or erosion above Marker 1. The heavy rains of October and November however, have taken a toll on the right bank area bordering Pete's Farm (Marker 1/0). This site has been slowly eroding for the last 15 years but this year a large section has slumped into the channel. See photo L1 and .xls spreadsheet entitled Disturbance sites and GPS coordinates for Area 25, 2016.

35.5. Update to Stream Survey Protocols

Current Assessment Method: The crew spots a vehicle at Pete's Farm and drives a second vehicle or gets dropped off at Marker 4 (Head Bay Road bridge). From the bridge, the crew hikes along the Leiner River Boulder Trail upstream to Marker 7 where the survey starts. The hike takes about 75 minutes.

Depending on flows, visibility and fish numbers, the survey generally takes about 4-5 hours including rest breaks to complete.

Deviations from current assessment protocols: Method consistent with 2015 survey.

Access Updates:	River access to upper river is consistent with 2015.
Safety Update:	There are no safety issues outside the normal in-stream hazards present on the Leiner River. The new Boulder Patch Trail has provided an easier and safer hike into Marker 7 and has shortened the hike from the bridge to the start point to 50 minutes.

35.6. Enhancement

Brood Removal:

Stock		Adults				Juveniles		
	Egg Target	Brood Target		Brood Collected		Release Target	Release Stage	Release Site
		Male	Female	Male	Female			
Leiner River Chinook	160,000	40	40	66	77	150,000	Seapen Smolt	Tahsis Inlet

Other enhancement and restoration activities:
Currently none.

35.7. Biosamples

Age Distribution (n=): 1.2% 2_1, 20.7% 3_1, 76.8% 4_1, 1.2% 5_1

Hatchery Contribution (n=90): 81% Hatchery [52% Leiner, 26% Conuma, 2% Robertson, 1% Tlupana], 19% unmarked

35.8. Concerns and Comments

- Missing marker signs on the Leiner were replaced this year and UTM coordinates recorded.
- A GPS track was also completed for the Leiner tracing the complete survey route.
- The staff gauge at Marker 4 is missing and needs to be replaced.
- A drone was used for an aerial perspective around marker 5.

36. ZEBALLOS RIVER

36.1. Stream Summary

The Zeballos River flow south into the north end of Zeballos Inlet in Nootka Sound. The lower river runs through the town of Zeballos. It is a large river system that drains a large area. The mainstem is over 26 km long, but there are cascades at 1.3 km up from the mouth which are a barrier to salmon. The river below the cascades have been divided into three 500 m survey sections (Figure 36-1). Most of the watershed has been logged and the system is flashy. The canyon pool moderates flow in the lower river, however after strong rain events the system is usually too dangerous to swim.

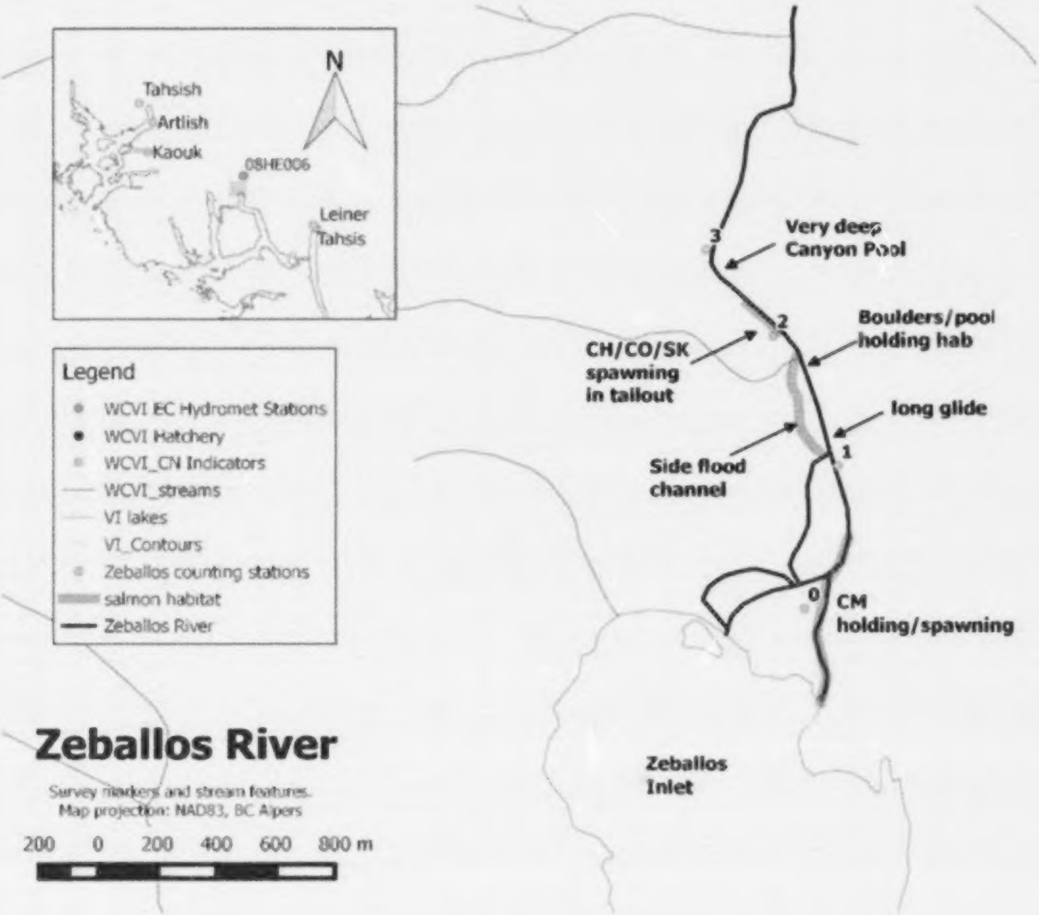

N
Tahsish
Artlish
Kaouk
08HE006
Leiner
Tahsis
Legend
WCVI EC Hydromet Stations
WCVI Hatchery
WCVI_CN Indicators
WCVI_streams
VI lakes
VI_Contours
Zeballos counting stations
salmon habitat
Zeballos River
Zeballos River
Survey markers and stream features.
Map projection: NAD83, BC Albers
200 0 200 400 600 800 m
3
Very deep Canyon Pool
2
Boulders/pool holding hab
CH/CO/SK spawning in tailout
long glide
Side flood channel
1
0
CM holding/spawning
Zeballos Inlet

Figure 36-1. Zeballos River survey markers. Map inset show locations of other systems that are regularly surveyed in the area as well as the location of the Environment Canada hydromet station on the Zeballos River at Zeballos (08HE006). Rivers and coastline are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia.

The water colour is clear but gets very silty after rain events. Observing conditions can be a problem on the Zeballos because of steep canyons creating low light levels. It is best to survey the system mid-day when the sun is highest. Visibility and species identification can be a problem in the pools.

There is an engineered overflow channel in the floodplain below the canyon that relieves floodwaters and acts as a spawning channel. Substrate is mostly cobble and gravel. Chum tend to spawn in the lower glides and upper tidal area. Chinook, Coho and Sockeye tend to spawn in the tail-out of the canyon pool. There is a bridge between markers 0 and 1.

There is a hatchery in Zeballos that is run as a collaboration between Ehattesaht and the Zeballos Elementary and Secondary School with a focus on Chum. Contacts are Elmar Nabb, Lyle Billy, Dave Ewart, Stacey Larson.

36.2. Survey results and escapement estimate

Survey Crew: NTC (R. Dunlop, S. Saasin), BCCF (J.Atkinson, S. Foxall)
Stock Assessment Biologist: D. McHugh

The Zeballos River was surveyed five times, September 12, September 23, September 29, October 4 and November 17, 2016. Due to the heavy rains that persisted throughout October, the windows available for additional surveys were very small.

Survey Data:

Table 36-1. Unexpanded live (L) and dead (D) counts by species for each survey, peak live plus dead (PL+D) raw and expanded for OE. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:
For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%; For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

			SK		**CO**		**PK**		**CM**		**CN**	
Date	**OE cat.**	**Comments**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**
12-Sep	Excellent										1	
23-Sep	Excellent	Water level normal, water clear	150		20				40		253	
29-Sep	Good	Water level normal, water tea	640		152				4012	9	9	
04-Oct	Good	Water level normal, water clear	1700		591				9210	21	155	
19-Oct	*	Water level above normal, bank walk	3	2	33				16140	157		1
17-Nov	Fair	Water level above normal, water slightly turbid	14						2		1	
		Raw PL+D	1,700		591				9,231		253	
		Exp PL+D	2,125		739				10,257		281	

*Bankwalk from Canyon to bridge, not used in AUC due to inconsistent method and survey area

Table 36-2. Survey life (SL), adult escapement estimate and rational how the method was applied. Escapement estimates use the OE described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Sp.	**SL**	**First Zero**	**Last Zero**	**Comments**	**Annual escapement estimate**	**Analytical method**	**Data quality level**
SK					2125	PL+D	3
CO					739	PL+D	3
PK					None Observed		
CM	15 (10-20)	Sept 1	Nov 20		18,400 (13,800-27,599)	AUC	2
CN	20 (15-25)	Sept 1	Nov 20		362 (289-482)	AUC	3

Escapement Commentary:

Due to only two surveys having been conducted on Zeballos River in 2015, comparison between the two years should be taken cautiously.

SK return:	Above the 12 year average (1300) Peak 2015 – 259 (Oct 26); Peak 2016 – 1700 (Oct 4)
CO return:	Above the 12 year average (375) Peak 2015 – 427 (Oct 26); Peak 2016 – 591 (Oct 4).
PK return:	
CM return:	Above the 12 year average (5800) Peak 2015 – 9,200 (Oct 15); Peak 2016 – 16,140* (Oct 19). Data for the October 19 survey was taken by Roger Dunlop via shoreline visual survey and was only of survey reaches 3 and 2.
CN return:	Above the 12 year average (225) Peak 2015 – 235 (Oct 26); Peak 2016 – 155 (Oct 4).

36.3. Spawner Distribution

Run Timing:

Table 36-3. The run timing for the survey year by species.

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye					Mid Aug	Late Oct	Late Nov
Coho					Early Sept	Early Jan	Late Jan
Pink					Mid Sept	Late Sept	Early Oct
Chum					Early Sept	Late Oct	Late Nov
Chinook					Early Sept	Late Oct	Late Nov

Comments:

Spatial distribution:

Table 36-4. The survey sections used by spawners per species.

Species	Survey Section(s) used for spawning
Sockeye	Marker 3 – Canyon Pool to its tail-out supports most of the river's Sockeye.
Coho	Marker 3/2 – Canyon Pool down to the bridge
Pink	
Chum	Marker 3/1 – Chum reside within the entire anadromous length of the river
Chinook	Marker 3/2 – Canyon Pool down to the bridge
Steelhead	

36.4. Environmental Conditions

Weather Summary:	The weather in the Zeballos Region was very wet starting early October and continuing into late November, 2016. From October 12 – 31 it rained everyday with an average rainfall of 24.3 mm/day and a maximum of 102.0 mm/day on October 25, 2016 (Kaouk River Hydromet Data) . Rains in November were greater than in October with an average rainfall of 44.5 mm/day and a maximum of 274.5 mm/day on November 7, 2016 (Kaouk River Hydromet Data). Our November 17 and 18, surveys occurred on the days that had the lowest rains in November.
Physical Characteristics Update:	The Zeballos River is a relatively stable system. The large fall flows throughout the Zeballos Region did not affect the survey section in any substantial way.

36.5. Update to Stream Survey Protocols

Current Assessment Method:	Crew parks truck at the bridge located approximately halfway down they survey reach. They then hike up to the falls pool, swim up towards the falls and then subsequently start they survey. The hike up takes approximately 30 min. The survey takes >1 hour depending on flows, visibility decreases substantially as flows increase. The crew gets out at the campsite at marker 0.
Deviations from current assessment protocols:	Method consistent with 2015 surveys.
Access Updates:	
Safety Update:	

36.6. Enhancement

Brood Removal:

Planned Release Numbers and Strategy:

Other enhancement and restoration activities:

36.7. Concerns and Comments

- Marker signs need to be replaced.
- GPS track was completed for the system.

37. BURMAN RIVER

37.1. Stream Summary

The Burman River flows west into Matchlee Bay in Muchalat Inlet in Nootka Sound. Most of the watershed, including the headwaters, is located in Strathcona Provincial Park to the east which means there has been less logging activity. The system is 25 km in length and fed mainly by many small tributaries and snow melt. Popsicle Creek, located about 9 km from the mouth, is the largest tributary. The majority of spawning occurs in the lower 8 km of the system which has been divided into 500 m sections for salmon enumeration (Figure 37-1).

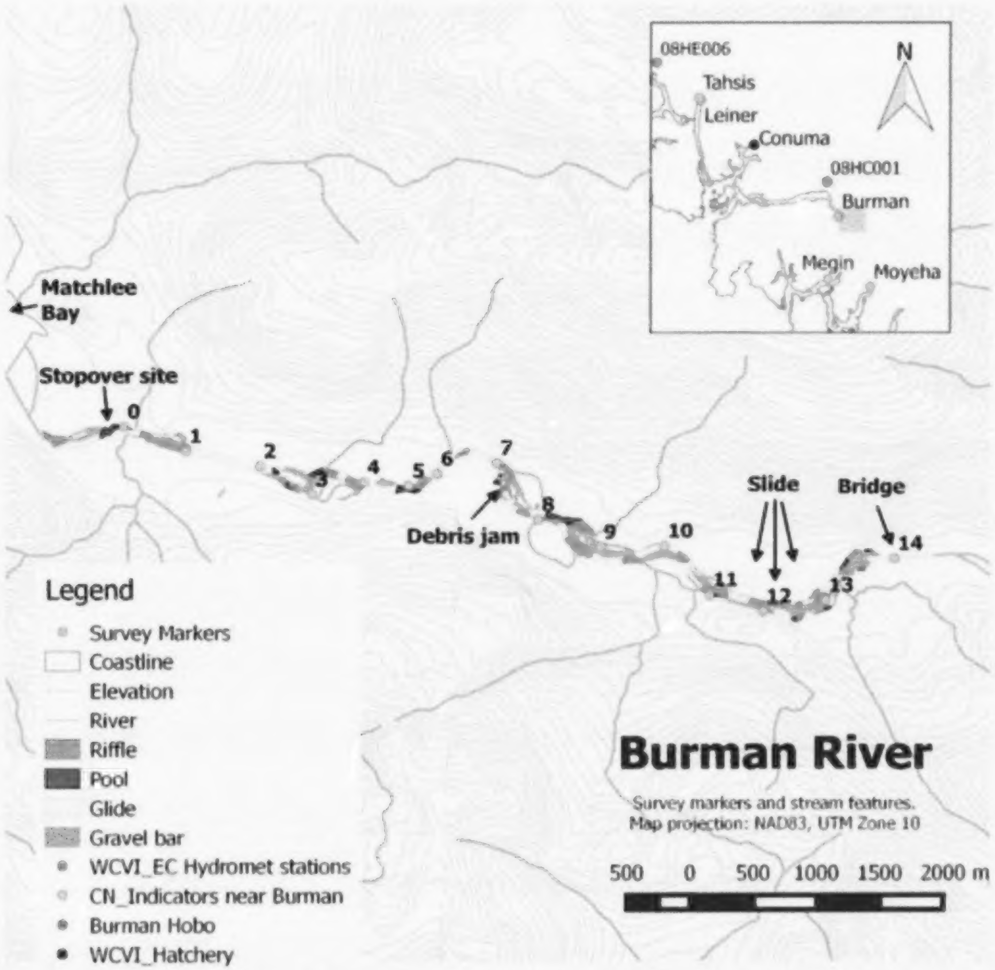

08HE006
N
Tahsis
Leiner
Conuma
08HC001
Burman
Megin
Moyeha
Matchlee Bay
Stopover site
0
1
2
3
4
5
6
7
Debris jam
8
9
10
Slide
Bridge
11
12
13
14
Legend
Survey Markers
Coastline
Elevation
River
Riffle
Pool
Glide
Gravel bar
WCVI_EC Hydromet stations
CN_Indicators near Burman
Burman Hobo
WCVI_Hatchery
Burman River
Survey markers and stream features.
Map projection: NAD83, UTM Zone 10
500 0 500 1000 1500 2000 m

Figure 37-1. Burman River, habitat units and survey markers. Roads, rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. Habitat data were mapped in the field and / or digitized from recent high resolution orthophotographs by M.C. Wright and Associates Ltd. Map inset shows locations of other systems that are regularly surveyed in the area as well as the location of the Environment Canada hydromet station on the Gold River (08HC001).

In the upper survey sections, there are many runs, pools and short riffles. In the lower river there are longer riffles and glides with lots of gravel and excellent spawning habitat. The substrate consists of mainly mixed gravels and bedrock. The system is relatively stable, although in recent years erosion has been observed in upper survey sections.

The system has numerous pools and there large slide between markers 10 and 13 that entered the river years ago. Most fish spawn below the slide but observations are made above as well. There is a bridge at marker 14 which is also the location of the Hobo water monitoring station and the start of the survey. A unique feature of the Burman River is the stopover pool below marker 0 where fish hold for several days before moving to the spawning grounds. The pool is tidal and not part of the standard survey sections.

The Burman is generally described as a clear system. It rises quickly after rain events, but returns to normal levels within several days. During high water the system turns an opaque green color from high suspended sediment loads. The system accumulates algae on the rocks over the summer which is washed out with the first major rain event. The worst clarity is usually after this first rain event and for the rest of the fall and winter the system is generally clear.

In recent years there have been several restoration activities and tagging studies. DFO installed a hydromet station with a HOBO data logger on the Burman River at survey marker 15 in August 2014. The system has been enhanced by the Conuma Hatchery since the 1980s.

37.2. Survey results and escapement estimate

Survey Crew: NTC/Muchalaht-Mowachat First Nation (R. Dunlop, G. Mark, K. Snook, J. Jack, D. Savey)
Stock Assessment Biologist: D.McHugh

A large number of surveys were completed in the Burman associated with a Mark-Recapture project undertaken by the NTC. Tags were applied and recaptured in a tide-influenced holding pool just below the standard counting section. Multiple SILs were submitted for many of the surveys as each surveyor filled out their own SIL rather than combining their observations into a best estimate for each section.

This work is described in the Dunlop and Dick's 2017 report 'Abundance and origin of the Chinook salmon (Oncorhynchus tshawytscha) spawning escapement in 2016 at Burman River, west coast Vancouver Island', which was prepared on behalf of the Nuu-chah-nulth Tribal Council for the Pacific Salmon Commission`s Southern Boundary and Enhancement Fund (SEF). The report is available online at: http://www.psc.org/download/30/annual-reports/10292/burman-river-chinook-salmon-mark-recapture-report-2016.pdf.

Individual Survey Data:

Table 37-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
01-Sep-16	0		0		0		0		0	
08-Sep-16	247		12				230		708	
16-Sep-16	935		418				712	5	5458	3
16-Sep-16*	865		418		0		701		5063	
20-Sep-16	637		137				1340		2382	
22-Sep-16	450		315				11870	2	9140	2
22-Sep-16*	2238		636		0		1820	10	8797	4
22-Sep-16*	1354		586		0		1790	17	5255	14
30-Sep-16	474		350		0		3096		1567	
05-Oct-16	785		132		0	1	1672		573	
05-Oct-16*	585		95		0		1320		335	4
05-Oct-16*	963		165		0		2023	0	809	4
13-Oct-16**	34		40	1			394		156	3
13-Oct-16*	35		23		0		295		70	1
13-Oct-16*	31		52		0		492		242	4
18-Oct-16	127		140		0		1478		321	2
18-Oct-16*	162		140				1690		343	
18-Oct-16*	90		135				1265		295	2
24-Oct-16	434	1	632			8	639	57	67	31
24-Oct-16*	165		302				610		96	
24-Oct-16*	581		952				622	69	36	31
31-Oct-16	131		211				34			4
PL+D	935		632		8		11,872		9,142	
Exp PL+D	1,570		972		8		13,191		10158	

Comments: *individual observations not used directly in estimate. Oct counts used in the estimate are averages of the two individual counts. **Survey not used due to extremely poor survey conditions.

Table 37-2. Observer efficiency rationale. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:
For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%
For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

Date	OE category	Comments
01-Sep-16	Excellent	Water level 1.28m, visibility > 18m
08-Sep-16	Excellent	Water level below normal (0.93m), visibility 12m
16-Sep-16	Excellent	Water level extremely low (0.68m), visibility 10m
20-Sep-16	Good	Water level normal (1.19m and dropping), visibility 17m,
22-Sep-16	Excellent	Water level below normal (0.97m), clear, visibility >15m.
30-Sep-16	Excellent	Water level below normal (0.81m), visibility 12m
05-Oct-16	Poor	Water level normal (1.05m and rising), visibility 3-5m
13-Oct-16	Very Poor	Water level flood (1.52m), visibility 0-1m, heavy rain
18-Oct-16	Poor	Water level flood (1.41m), visibility 8m, raining
24-Oct-16	Fair	Water level normal (1.32m), visibility 1-3m
31-Oct-16	Good	Water level normal (1.22m), visibility 12m

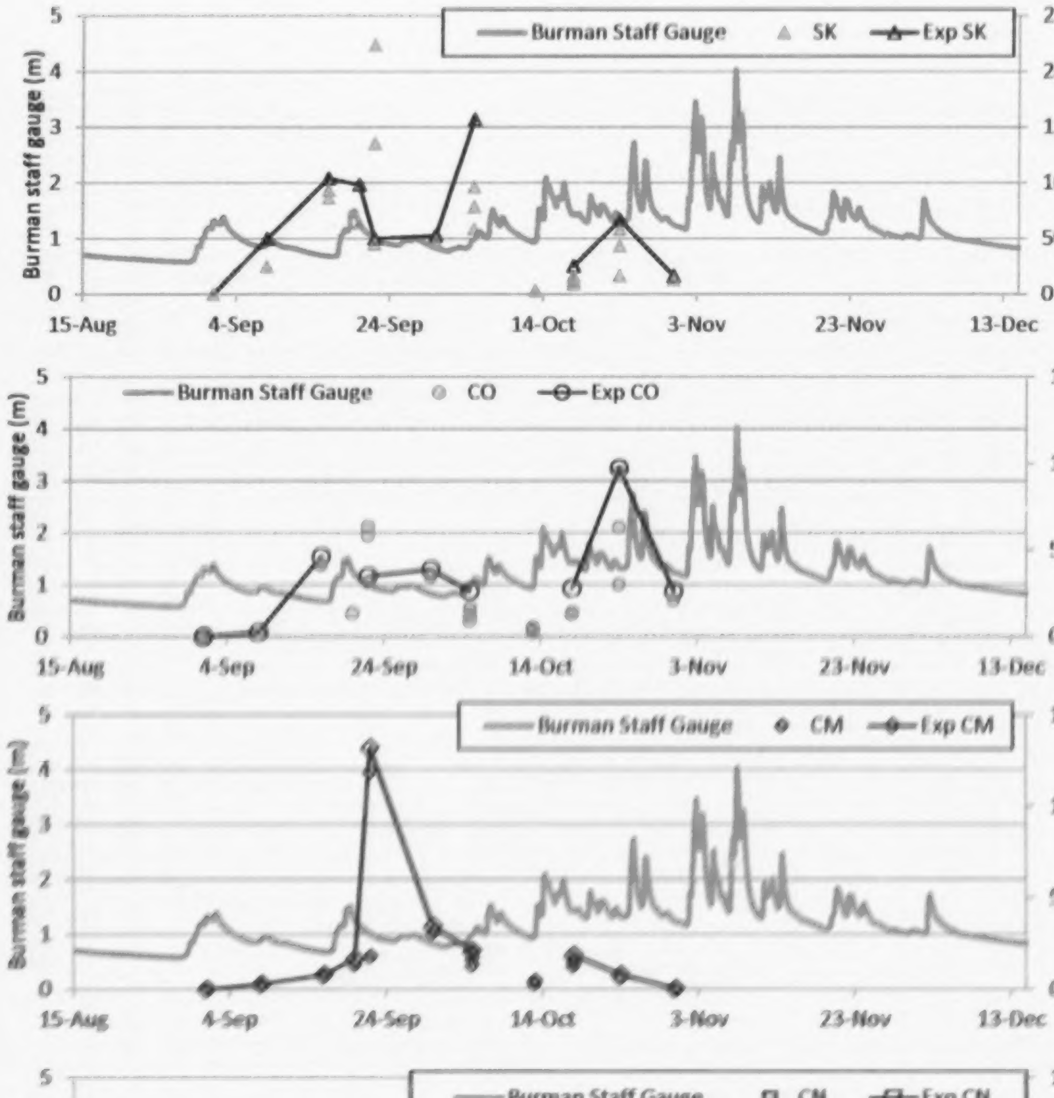


Figure 37-2. Raw counts (solid marker) and expanded counts (open marker) for each species. The water level/discharge is from the nearest or most representative hydrometric station

Table 37-3. Survey life (SL), adult escapement estimate and rational how the method was applied. Escapement estimates use the OE described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Sp.				Annual escapement estimate	Analytical method	Data quality level
SK	25 (20-30)	Sept 1	Nov 15	1,575 (1,310-1,964)	AUC	3
CO	23 (18-28)	Sept 1	Nov 15	982 (807-1,255)	AUC	3
PK				8	PL+D	3
CM	10.5 (7-14)	Sept 1	Nov 15	13,467 (10,100-20,200)	AUC	2
CN	14 (10-18)	Sept 1	Nov 15	10,534 (8,193-14,748)	AUC	3

General comments: Applying the radio tag CM SL of 5.7 (2.2-9.1) days = 25,027 (15,539-64,274), applying the std CM SL 15 (10-20) = 9,427 (7,070-14,140)

Additional Information: Mark Recapture estimate of chinook in the lower pool produced by the NTC was 10,444. 63 radio tags put on chum in the lower pool (19 Sept 20, 44 Oct 11/12). The time between movement into the survey area, above the tagging pool, and death was around 5.6 days for both groups. The time between tagging and death was longer for the chum tagged earlier (15.5 days for chum tagged Sept 19th, 8.6 days for chum tagged Oct 11/12th).

Escapement Commentary:

SK return:	Above the 12 year average (750)
CO return:	Less than the 12 year average (1300)
PK return:	-
CM return:	Above the 12 year average (4800)
CN return:	Above the 12 year average (2400)

37.3. Spawner Distribution

Run Timing:

Table 37-4. The run timing for the survey year by species.

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye					Mid Sept	Late Sept	Early Oct
Coho						Late Oct	
Pink							
Chum					Mid Sept	Mid Oct	Late Oct
Chinook					Mid Sept	Late Sept	Early Oct

Spatial distribution:

Table 37-5. The survey sections used by spawners per species.

Species	Survey Section(s) used for spawning
Sockeye	
Coho	
Pink	
Chum	
Chinook	

Comments: % Spawning not recorded by section, all species start at section 2, in previous years Chum mostly 6 down and Chinook throughout,

37.4. Environmental Conditions

Weather Summary:

Physical Characteristics Update:

37.5. Update to Stream Survey Protocols

Current Assessment Method: Two swimmers from marker 14 to 0 starting at the beginning of September every 7-10 days through October for a total of 6-8 surveys.

Deviations from current assessment protocols: As in 2009-2015, a Mark-Recapture project was conducted by the NTC to estimate the Chinook abundance. So quite a few additional surveys occurred to support that estimation method, which requires recaptures of tagged fish, well in excess of the number (5-8) typically used to estimate the escapement based on the AUC method typically used.

Access Updates: Permanent dock has been installed, but portable bridges in the lower river may be removed. When accessing you should inform the MMFN fisheries manager.

Safety Update: The BCTS are still planning to fly out a large amount of timber, so we need to avoid their flight path. Road is likely to be blocked by windfall, some quite large, bring two chainsaws and winch.

37.6. Enhancement

Brood Removal:

222 Chinook removed by Conuma Hatchery Sept 16, very few jacks observed, based on the one day of brood capture, hatchery staff estimated ~4,650 natural spawners. Drone and jet boat used to look for Chinook.

37.7. Biosamples

Based on the otoliths, the deadpitch samples were ~30% unmarked, ~60% Burman hatchery stock, and ~10% Conuma hatchery stock. The broodstock samples, collected in the bottom end of the river, were a lower proportion unmarked (~15%), ~72% Burman hatchery stock, ~12% Conuma hatchery stock, and ~1% Gold River hatchery stock.

37.8. Concerns and Comments

38. ESPINOSA CREEK

38.1. Steam Summary

Espinosa Creek flows south into the head of Espinosa Inlet with the Nuchatlaht First Nation village of Oclucje located at the mouth. The mainstem is about 8 km long, but only the lower 800 m are surveyed because of falls which are a barrier to migration. The water colour is generally clear and the riparian is mature forest. The survey starts at a pool at the base of falls. The pool is hard to survey as is the lower system at a high tide.

All salmon species may be found throughout the system with Chum more abundant in the lower system.

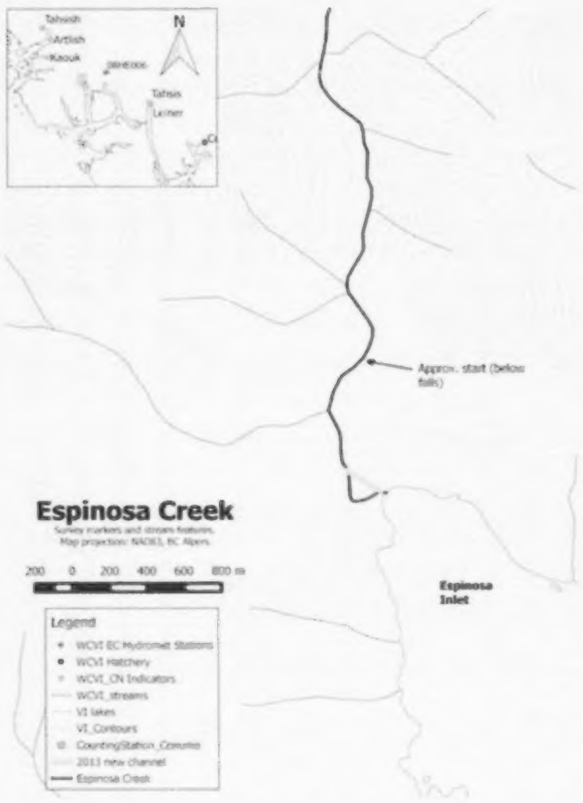

Tahsish
Artlish
Kaouk
08HE006
N
Tahsis
Leiner
Approx. start (below falls)
Espinosa Creek
Survey markers and stream features.
Map projection: NAD83, BC Albers.
200 0 200 400 600 800 m
Legend
WCVI EC Hydromet Stations
WCVI Hatchery
WCVI_CN Indicators
WCVI_streams
VI lakes
VI_Contours
CountingStation_Conuma
2013 new channel
Espinosa Creek
Espinosa Inlet

Figure 38-1. Espinosa Creek location. Roads, rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. Map inset shows locations of other systems that are regularly surveyed in the area as well as the location of the Environment Canada hydromet station Zeballos River at Zeballos (08HE006)).

38.2. Escapement estimates

Survey Crew: Mowachat/Muchalaht (R. Dunlop, J. James)
Stock Assessment Biologist: D. McHugh

Table 38-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
12-Sep-16										
23-Sep-16							6			

Comments:

38.3. Escapement comments:

Not enough info for an escapement estimate.

38.4. Environmental Conditions

38.5. Survey protocols

Stream walk/Snorkel: There is road access via the Zeballos to Fair Harbour road or there is a dock near the end of Espinosa Inlet if accessing the site by boat. Access to the site is located in the village of Oclucje of the Nuchatlaht First Nation. It is advised that surveyors contact the First Nation ahead of time to inform the Nuchatlaht of your visit. If mooring at the dock, you will need to walk with your gear on, along the road until you reach the village (~1000m). From the village, walk along the bottom road that follows the shoreline and continue on until you reach a treatment plant (sea can). The creek is on the left and there is a worn path that runs along the creek. When the path strays from the creek bank, you have to walk in the stream until you reach the waterfall barrier. The survey starts at the waterfall.

38.6. Concerns and Comments

- About 150m of the best lower river low gradient habitat lost to abandonment of ~350m of channel by avulsion at big stump in 2013. There are plans to restore the channel.
- No bear sign

39. LITTLE ZEBALLOS RIVER

39.1. Stream Summary

The Little Zeballos River flows west then south into Zeballos Inlet. The mainstem length is over 11 km but only the lower 3 km are surveyed. The Little Zeballos River watershed has been heavily logged and the stream is a flashy with much gravel movement and changes in stream channel morphology and braiding annually. It tends to be ephemeral especially during summer months. Its surveyed length is mostly low gradient ~2% with mostly cobble and gravel substrate. Water colour is described as 'gin clear' but will be silty during high water events. Observer efficiency is generally good because the system is smaller, narrow and there are not too many places for fish to hide. Riparian is a young forest. Much of the spawning activity takes place in side channels. There are large gravel fans and little deep pool habitat in the mid reaches of stream.

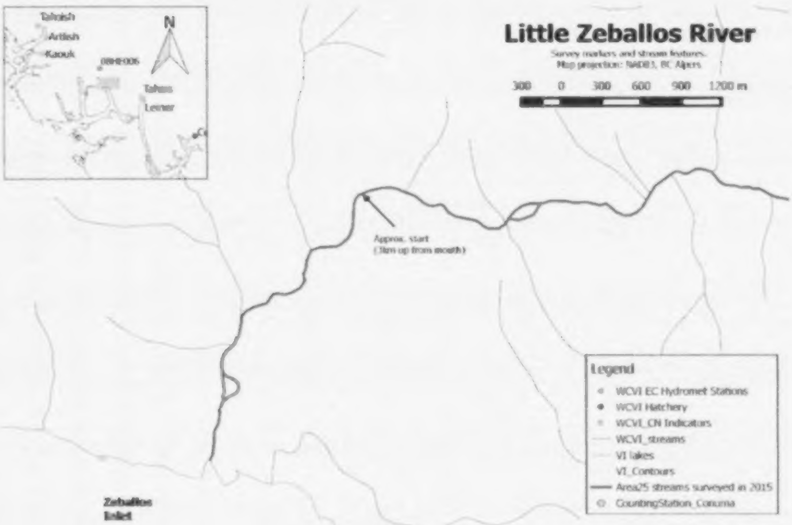

Little Zeballos River
Survey markers and stream features.
Map projection: NAD83, BC Albers
300
0
300
600
900
1200 m
Tahsish
Artlish
Kaouk
08HE006
Tahsis
Leiner
N
Approx. start
(3km up from mouth)
Zeballos
Inlet
Legend
WCVI EC Hydromet Stations
WCVI Hatchery
WCVI_CN Indicators
WCVI_streams
VI lakes
VI_Contours
Area25 streams surveyed in 2015
CountingStation_Conuma

Figure 39-1. Location of the Little Zeballos River. Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. Map inset shows locations of other systems that are regularly surveyed in the area as well as the location of the Environment Canada hydromet station Zeballos River at Zeballos (08HE006)).

39.2. Escapement estimates

Survey Crew: BCCF (J. Atkinson, S. Foxall)
Stock Assessment Biologist: D. McHugh

The aim is to get four surveys to get a good estimate for Chum.

Table 39-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
29-Sep-16	107		207				884	3	30	
04-Oct-16	113		556				841	2	95	
17-Nov-16	13		145	4			86	40	5	
PL+D	113		556				887		95	
Exp PL+D	126		618				986		106	

39.3. Escapement comments:

The Little Zeballos River was surveyed three times, September 29, October 4 and November 17, 2016. Due to the heavy rains that persisted throughout October, the windows available for additional surveys were very small. The surveys likely missed the chum peak in mid-October.

SK return:	Peak 2016 - 113 (Oct 4, 2016)
CO return:	Peak 2016 – 556 (Oct 4, 2016)
PK return:	
CM return:	Peak 2016 - 884 (Sept 29, 2016)
CN return:	Peak 2016 - 215 (Sept 29, 2016)

39.4. Spawner Distribution

Run Timing:

Species	**Estuary**			**Arrival in Stream**	**Dates of Spawning**		
	Arrival	**Peak**	**End**		**Start**	**Peak**	**End**
Sockeye					Mid Aug	Late Sept	Late Nov
Coho					Late Sept	Early Jan	Late Jan
Pink					Mid Sept	Late Sept	Early Oct
Chum					Early Sept	Late Oct	Late Nov
Chinook					Early Sept	Late Oct	Late Nov

Spatial Distribution:

Species	**Survey Section(s) used for spawning**
Sockeye	Marker 6/1 – Sockeye reside throughout all survey reaches, spawning distribution is unknown. Although it is likely that they spawn throughout all reaches in deep pools.
Coho	Marker 6/2 – Coho reside throughout the system. Most spawning occurs in the upper 4 marker 6-3) reaches.
Pink	
Chum	Marker 6/1 – Chum spawn within the entire anadromous length of the river
Chinook	Marker 6/2 – Chinook reside throughout the system. Spawning most likely occurs in the upper reaches and most likely past the cascades.
Steelhead	

39.5. Environmental Conditions

Weather Summary:

The weather in the Zeballos Region was very wet starting early October and continuing into late November, 2016. From October 12 – 31 it rained everyday with an average rainfall of 24.3 mm/day and a maximum of 102.0 mm/day on October 25, 2016 (Kaouk River Hydromet Data).

Rains in November were greater than in October with an average rainfall of 44.5 mm/day and a maximum of 274.5 mm/day on November 7, 2016 (Kaouk River Hydromet Data). Our November 17 and 18, surveys occurred on the days that had the lowest rains in November.

Physical Characteristics Update:

The Little Zeballos River is a fluid system and changes throughout the 2016 survey season were evident. Heavy rains throughout October and November caused bank erosion and the subsequent increase in LWD presence within the river.

39.6. Update to Stream Survey Protocols

Current Assessment Method:

Crew launches in Zeballos Harbour and boats out to the mouth of the Little Zeballos River. The crew then hikes up the Little Zeballos until the cascades (marker 6, km 3), then surveys the river back down towards the docking location.

The Little Zeballos survey from launching the boat till return to the dock takes ~5 hours. Method consistent with 2015 surveys.

Deviations from current assessment protocols:

Access Updates:

Safety Update:

39.7. Concerns and comments

- All marker signs replaced in 2016.
- GPS track taken of Little Zeballos River
- Marker two needs to be replaced due to high flows removing its anchor tree.

40. PARK RIVER

40.1. Stream Summary

The Park River flows south into Queen Cove on the east side of the inlet, Port Eliza. The mainstem length is 8.5 km and the lower 2.5 km is surveyed. Park River is lake buffered. It is stable and maintains a fairly consistent flow. High quality spawning gravel is available throughout most of its length but there are few holding pools. The gradient is 2% or less throughout. Much of the watershed has been logged in recent years, but there is a generous buffer of old growth conifers along the creek. The water colour is like tea and surveyors comment it is hard to see in the pools.

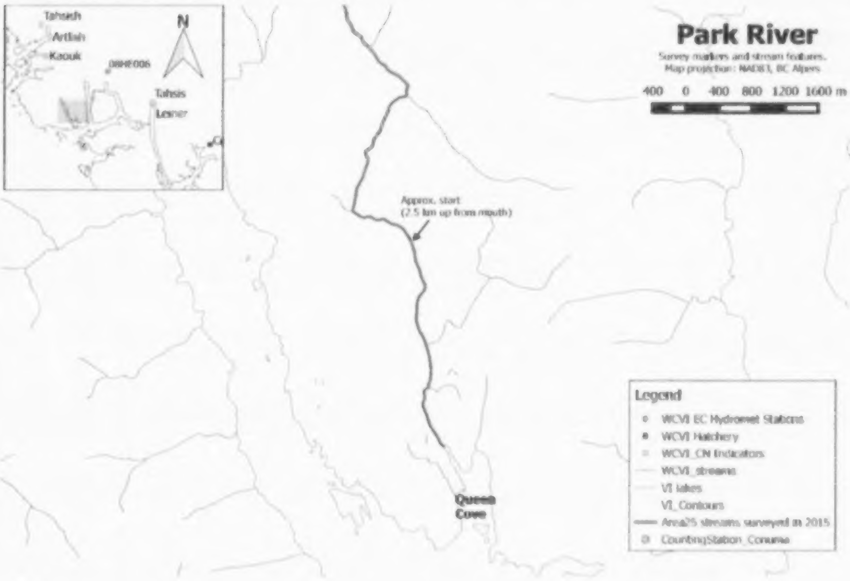

Tahsish
Artlish
Kaouk
08HE006
N
Tahsis
Leiner
Park River
Survey markers and stream features.
Map projection: NAD83, BC Albers
400 0 400 800 1200 1600 m
Approx. start
(2.5 km up from mouth)
Queen
Cove
Legend
WCVI EC Hydromet Stations
WCVI Hatchery
WCVI_CN Indicators
WCVI_streams
VI lakes
VI_Contours
Area25 streams surveyed in 2015
CountingStation_Conuma

Figure 40-1. Location of the Park River. Rivers and coastline are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. Map inset shows locations of other systems that are regularly surveyed in the area as well as the location of the Environment Canada hydromet station Zeballos River at Zeballos (08HE006).

40.2. Escapement estimates

Survey Crew: BCCF (K. Pellet, M. Friesen)
Stock Assessment Biologist: D. McHugh

Table 40-1. Unexpanded live and dead counts by species for each survey.

Date	**SK**		**CO**		**PK**		**CM**		**CN**	
	Live	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**
24-Oct-16	35	1	248	1			9111	1512		
PL+D	36		249				10,623			
Exp PL+D	55		383				13,279			

Comments:

40.3. Escapement comments:

Park Creek was surveyed once, Oct 24, in 2016. Due to the heavy rains that persisted throughout October, the windows available for additional surveys were very small. This stream proves to be the most difficult system to survey, due to poor access and the longevity of the survey.

40.4. Spawner Distribution

Run Timing:

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye					Mid Aug	Late Sept	Late Nov
Coho					Late Sept	Early Jan	Late Jan
Pink					Mid Sept	Late Sept	Early Oct
Chum					Early Sept	Late Oct	Late Nov
Chinook					Early Sept	Late Oct	Late Nov

Comments:

Spatial distribution:

Species	Survey Section(s) used for spawning
Sockeye	Marker 5 – Lake outlet
Coho	Marker 5/2 – Lake outlet to marker 2. Most spawning occurs near lake outlet.
Pink	
Chum	Marker 5/1 – Chum spawn within the entire anadromous length of the river
Chinook	
Steelhead	

Comments: An adipose clipped Coho was observed during survey, the clipped fish was located in marker 1 segment.

40.5. Environmental Conditions

Weather Summary: The weather in the Zeballos Region was very wet starting early October and continuing into late November, 2018. From October 12 – 31 it rained everyday with an average rainfall of 24.3 mm/day and a maximum of 102.0 mm/day on October 25, 2016 (Kaouk River Hydromet Data).

Rains in November were greater than in October with an average rainfall of 44.5 mm/day and a maximum of 274.5 mm/day on November 7, 2016 (Kaouk River Hydromet Data).

Physical Characteristics Update: Park Creek is a relatively stable system with old growth and low lying flats. Due to the low amounts of surveys conducted on Park Creek any conclusions on changes in the system cannot be made.

40.6. Survey protocols

Once the survey crew arrives in Queens Cove via logging roads from Zeballos. The crew launches the skiff and drive to the Park Creek estuary. From there the crew hikes up the creek for 2.4 km until the upper lake outlet.

Surveying Park Creek via logging roads from Zeballos has been estimated to take 8 hours. The survey is best if it can be done at low to half-tide. Methods consistent with 2015 surveys.

Access in 2015 was via boat, from Zeballos. This year access was only available by logging roads.

40.7. Enhancement/restoration activities

40.8. Concerns and comments

- Stream markers were replaced throughout
- A GPS track was taken.
- There is logging in the upper basin above the lake.
- There were many bears in 2016.

41. CHUM CREEK

41.1. Stream Summary

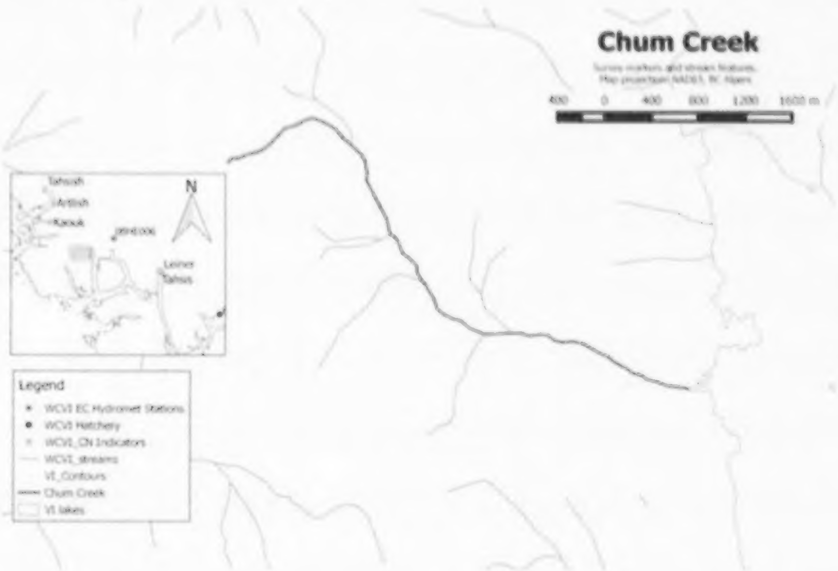

Chum Creek
400 0 400 800 1200 1600 m
Tahsish
Artlish
Kaouk
08HE006
N
Leiner
Tahsis
Legend
WCVI EC Hydromet Stations
WCVI Hatchery
WCVI_CN Indicators
WCVI_streams
VI_Contours
Chum Creek
VI lakes

Figure 41-1. Location of the Chum Creek. Rivers and coastline are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. Map inset shows locations of other systems that are regularly surveyed in the area as well as the location of the Environment Canada hydromet station Zeballos River at Zeballos (08HE006).

Chum Creek flows east into Espinosa Inlet in Nootka Sound. It is a small creek brownish coloured water and with old growth in the watershed. The mainstem is 5.7km but there are falls about one kilometer from the mouth which is a barrier to fish migration.

41.2. Escapement estimates

Survey Crew: BCCF (K. Pellet, M. Friesen, J. Atkinson, S. Stenhouse), NTC (R. Dunlop)
Stock Assessment Biologist: D. McHugh

Table 41-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
22-Sep-16			0		4				2	
24-Oct-16			6				3459	857		
18-Nov-16			15				14	20	1	
PL+D			15				4,316		2	
Exp PL+D			19				4,796		2	

Comments:

41.3. Escapement comments:

Chum Creek was surveyed three times, once by NTC (Sep 22), twice by BCCF (Oct 24 and Nov 18) in 2016. Due to the heavy rains that persisted throughout October, the windows available for additional surveys were very small.

Surveys were not conducted on Chum Creek in 2015. Due to the high flows throughout the fall of 2016, dead counts were minimal as it is assumed that carcasses have been washed out of the system.

41.4. Spawner Distribution

Run Timing:

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye					Mid Aug	Late Sept	Late Nov
Coho					Late Sept	Early Jan	Late Jan
Pink					Mid Sept	Late Sept	Early Oct
Chum					Early Sept	Late Oct	Late Nov
Chinook					Early Sept	Late Oct	Late Nov

Comments:

Spatial distribution:

Species	Survey Section(s) used for spawning
Sockeye	
Coho	Marker 2/1 – Coho are present throughout the survey reaches
Pink	
Chum	Marker 2/1 – Chum spawn within the entire anadromous length of the river
Chinook	
Steelhead	

Comments:

41.5. Environmental Conditions

Weather Summary:	The weather in the Zeballos Region was very wet starting early October and continuing into late November, 2018. From October 12 – 31 it rained everyday with an average rainfall of 24.3 mm/day and a maximum of 102.0 mm/day on October 25, 2016 (Kaouk River Hydromet Data). Rains in November were greater than in October with an average rainfall of 44.5 mm/day and a maximum of 274.5 mm/day on November 7, 2016 (Kaouk River Hydromet Data). November 17 and 18 had the lowest rain accumulation in November.
Physical Characteristics Update:	Chum Creek is a relatively stable system with a steep gradient. No noticeable erosion was evident although substantial LWD movement had occurred throughout the system.

41.6. Survey protocols

Logging road access to the upper section marker is easily accessible. Entrance into the survey section at the road bridge is easy. Full survey takes ~3 hours, starting from Zeballos. The lower 0.5 km is tidal so surveys should be done on a low tide.

41.7. Enhancement/restoration activities

41.8. Concerns and comments

- Stream markers were replaced throughout.
- A GPS track was taken.
- There was a lot of sediment in December 2016

42. TLUPANA RIVER

42.1. Stream summary

The Tlupana River flows southwest into Nesook Bay, on the northeast side Tlupana Inlet in Nootka Sound. The mainstem is 15 km long and the lower 5 km are surveyed for salmon enumeration. The system is stable with old growth in the watershed. There has not been as much logging as other watersheds and the system is relatively slow to respond to rain events.

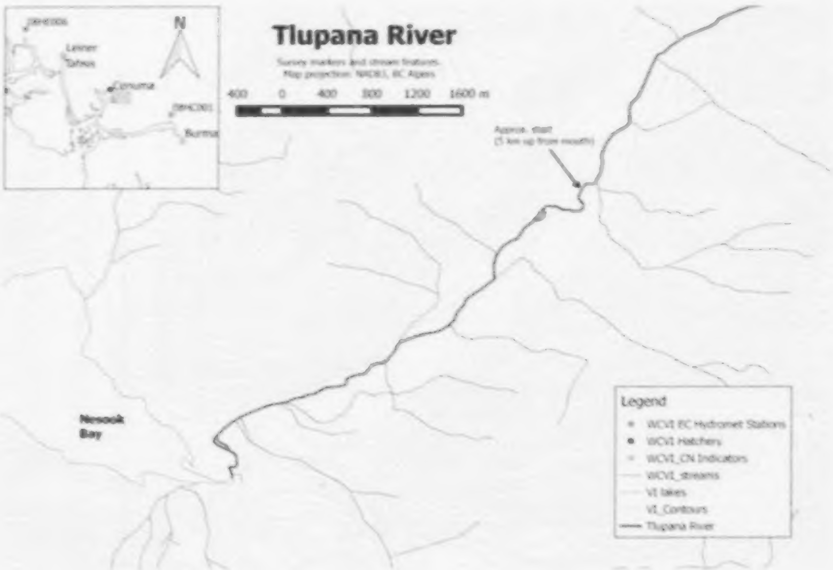

Tlupana River
Survey markers and stream features
Map projection: NAD83, BC Albers
400 0 400 800 1200 1600 m
N
08HE006
Leiner
Tahsis
Conuma
08HC001
Burman
Approx. start
(5 km up from mouth)
Nesook
Bay
Legend
WCVI EC Hydromet Stations
WCVI Hatchery
WCVI_CN Indicators
WCVI_streams
VI lakes
VI_Contours
Tlupana River

Figure 42-1. Location of the Tlupana River. Rivers and coastline are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. Map inset shows locations of other systems that are regularly surveyed in the area as well as the location of the Environment Canada hydromet station Zeballos River at Zeballos (08HE006).

42.2. Escapement estimates

Survey Crew: Conuma Hatchery
Stock Assessment Biologist: D. McHugh

Conuma River Hatchery staff visited Tlupana to collect chum broodstock Sept 23-Oct 17. A drone flight through the estuary and estuary pool on Sept 20 showed chum moving into the system.

42.3. Escapement comments:

SK return:

CO return:

PK return:

CM return:

CN return: 3,150 hatchery estimate of natural spawners

42.4. Environmental Conditions

42.5. Survey protocols

42.6. Enhancement/restoration activities

- Chum: 1,275 Chum brood removed by Conuma Hatchery (Sep 30-Oct 9)
- All broodstock was collected form the pools about 1km up-river from the estuary.

43. OKTWANCH RIVER

43.1. Stream summary

The Oktwanch River flows southwest into Muchalat Lake, which is joined to the Gold River via the Muchalat River. The system is described by surveyors as 'trashed', with wide, massive gravel bars, braided sections, and lots of boulders. At low flows there is very little water, but the system is subject to flooding after heavy rain. Water clarity is generally good except after heavy rain. Most large woody debris, including from a habitat restoration project done in the 1990s, has been washed out. The lower 2 km are surveyed for salmon enumeration.

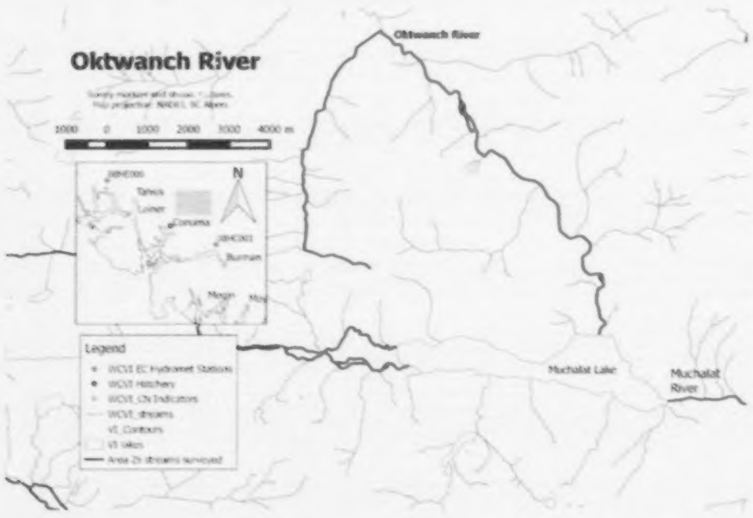

Oktwanch River
1000 0 1000 2000 3000 4000 m
N
Tahsis
Conuma
Burman
Legend
WCVI EC Hydromet Stations
WCVI Hatchery
WCVI_CN Indicators
WCVI_streams
VI_Contours
VI lakes
Oktwanch River
Muchalat Lake
Muchalat River

Figure 43-1. Location of the Oktwanch River. Rivers and coastline are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. Map inset shows locations of other systems that are regularly surveyed in the area as well as the location of the Environment Canada hydromet station Zeballos River at Zeballos (08HE006) and Gold River (08HC001).

43.2. Escapement estimates

Survey Crew: Muchalaht-Mowachat First Nation Fisheries (G. Mark, K. Snook, J. Jack)
Stock Assessment Biologist: D. McHugh

Table 43-1. Unexpanded live and dead counts by species for each survey.

Date	**SK**		**CO**		**PK**		**CM**		**CN**	
	Live	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**
Sept. 27									6	
Oct. 11	106									

43.3. Escapement comments:

43.4. Environmental conditions

43.5. Survey protocols

Crew covers 4 marked sections (2km)

STREAMS IN AREA 26 AND 27

44. AREA 26/27 SUMMARY OF OBSERVATIONS IN 2016

44.1. Overview

Over 25 streams and major tributaries in Area 26 have records of spawning salmon, and more than 60 in Area 27. The priority for escapement enumeration are the Chinook indicator stocks in Kaouk River, Artlish River and Tahsish River in Area 26, and Marble River and the Colonial/Cayeghle System in Area 27. Additional systems are surveyed when funding allows and typically less frequently than the indicator systems. Most systems are surveyed using the snorkel method described in the DFO snorkel survey manual. Occasionally systems are also surveyed by stream or bank walks.

In 2016, 7 systems were surveyed between the two areas (Figure 44-1). Additional surveys were planned, but were cancelled due to poor survey conditions mid-October through November. The three indicators as well as Malksope were surveyed frequently enough to allow a reliable application of the Area Under the Curve (AUC) estimation method for most species. Other systems were surveyed less frequently with the intent of making a less reliable, minimum estimate of escapement, usually based on the expanded Peak Live + Dead count.

The NVISEA (North Vancouver Island Salmon Enhancement Association) and the Friends of the Marble River Society operate the Marble River Hatchery to enhance Marble River Chinook. Benson River, Colonial/Cayeghle Creek and Goodspeed River have also been enhanced occasionally by various hatcheries in the past 20 years. There are no hatchery activities on systems in Area 26.

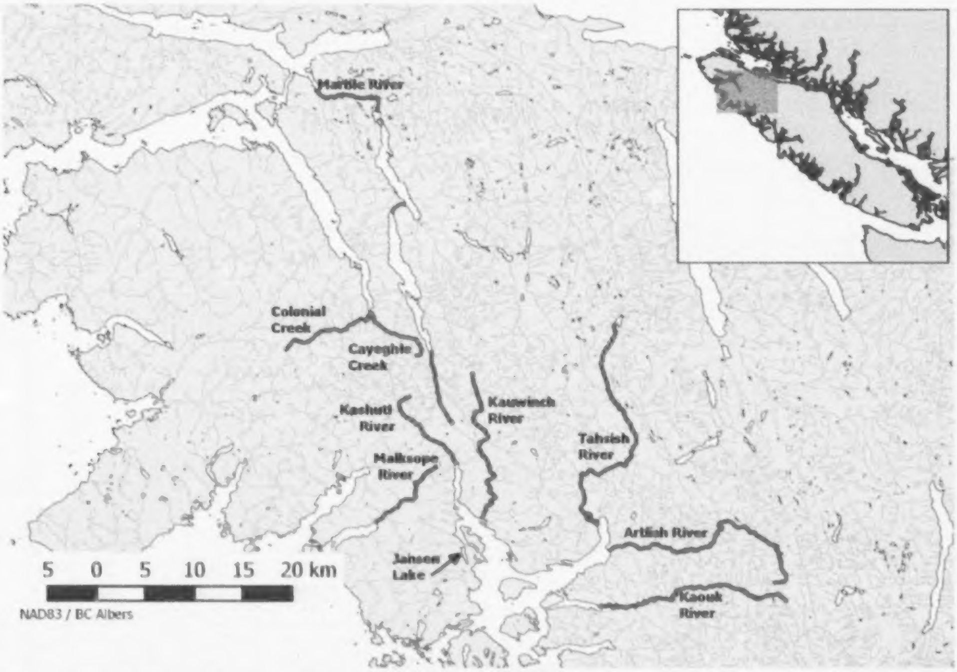


Figure 44-1. Streams in Areas 26 and 27 that were surveyed in 2016. Environment Canada Hydromet stations on the Zeballos River (08HE006) and Klaskish River Near Klaskino Inlet (08HE006) indicate flow on nearby ungauged systems. A DFO hydromet station was installed in Kaouk in Sept. 2014.

44.2. 2016 Operational Summary

Summary: September surveys occurred generally as scheduled, but mid to late-October surveys were disrupted by a series of major rain events.

Water levels and temperature were conducive to migration throughout the escapement season, but extreme rain events in November caused slumping and scouring which will likely affect egg survival for the 2016 brood year.

Table 44-1. Escapement: Raw Peak Live + Dead Adult counts by statweek and Preliminary Escapement Estimates, font indicates the level of spawning observed. Underline: 1-9% spawning, Italics: 10-49% spawning, Bold: >50% spawning.

Colour codes for escapement method and plan	
Bank Walk	Helicopter
Stream Walk	Fence
Snorkel	Missed
Boat	Revised plan

Colour codes for esc. Est. compared to the 12 year avg.
> 125%
75%-125%
50%-75%
25%-50%
<25%

System	Species	9-1 Aug 28-Sep 3	9-2 Sept 4-10	9-3 Sept 11-17	9-4 Sept 18-24	10-1 Sept 25-Oct 1	10-2 Oct 2-8	10-3 Oct 9-15	10-4 Oct 16-22	10-5 Oct 23-29	11-1 Oct 30-Nov 5	Esc Est
KAOUK RIVER	Sockeye		40	40	*35*	**20**	**20**	22		**13**		50
ARTLISH RIVER	Sockeye		8	9		9	7		0		0	12
MALKSOPE RIVER	Sockeye				9	9	10				**1**	12
TAHSISH RIVER	Sockeye		8			21	18				**3**	32
JANSEN CREEK	Sockeye				0						0	
KASHUTL RIVER	Sockeye					1						1
KAUWINCH RIVER	Sockeye					37						40

System	Species	9-1 Aug 28-Sep 3	9-2 Sept 4-10	9-3 Sept 11-17	9-4 Sept 18-24	10-1 Sept 25-Oct 1	10-2 Oct 2-8	10-3 Oct 9-15	10-4 Oct 16-22	10-5 Oct 23-29	11-1 Oct 30-Nov 5	11-2 Nov 6-12	11-3 Nov 13-19	11-4 Nov 20-26	11-5 Nov 27-Dec 3	12-1 Dec 4-10	12-2 Dec 11-17	Esc Est
KAOUK RIVER	Coho		**344**	**612**	1230	1283	1570	**1206**		**1736**							**230**	3,656
ARTLISH RIVER	Coho		71	128		231	288		291		728							963
MALKSOPE RIVER	Coho				564	809	907				867							1,759
TAHSISH RIVER	Coho		192			875	592				474							1,327
JANSEN CREEK	Coho				12						6							
KASHUTL RIVER	Coho					97												100
KAUWINCH RIVER	Coho					216												250

System	Species	9-1 Aug 28-Sep 3	9-2 Sept 4-10	9-3 Sept 11-17	9-4 Sept 18-24	10-1 Sept 25-Oct 1	10-2 Oct 2-8	10-3 Oct 9-15	10-4 Oct 16-22	10-5 Oct 23-29	11-1 Oct 30-Nov 5	Esc Est
KAOUK RIVER	Chum		14	27	*173*	**412**	**1197**	**1322**		**3633**		6,492
ARTLISH RIVER	Chum		9	20		*428*	**282**		**2905**		**14360**	15,956
MALKSOPE RIVER	Chum				154	634	1400				**1513**	3,000
TAHSISH RIVER	Chum		11			*720*	**779**				**1428**	3,441
JANSEN CREEK	Chum				0						0	
KASHUTL RIVER	Chum					136						150
KAUWINCH RIVER	Chum					376						400

System	Species	9-1 Aug 28-Sep 3	9-2 Sept 4-10	9-3 Sept 11-17	9-4 Sept 18-24	10-1 Sept 25-Oct 1	10-2 Oct 2-8	10-3 Oct 9-15	10-4 Oct 16-22	10-5 Oct 23-29	11-1 Oct 30-Nov 5	Esc Est
KAOUK RIVER	Chinook		213	215	*202*	183	142	66		32		370
ARTLISH RIVER	Chinook		114	*121*		86	78		5		7	207
MALKSOPE RIVER	Chinook				5	4	2				4	10
TAHSISH RIVER	Chinook		331			198	163				11	615
JANSEN CREEK	Chinook				0						0	
KASHUTL RIVER	Chinook					0						
KAUWINCH RIVER	Chinook					15						15

System	Species	9-1 Aug 28-Sep 3	9-2 Sept 4-10	9-3 Sept 11-17	9-4 Sept 18 24	10-1 Sept 25-Oct 1	10-2 Oct 2-8	10-3 Oct 9-15	10-4 Oct 16-22	10-5 Oct 23-29	Esc Est
MARBLE RIVER	Sockeye	0		0	0		0				
CAYEGHLE SYSTEM	Sockeye		0	1		0	3	0			3

System	Species	9-1 Aug 28-Sep 3	9-2 Sept 4-10	9-3 Sept 11-17	9-4 Sept 18 24	10-1 Sept 25-Oct 1	10-2 Oct 2-8	10-3 Oct 9-15	10-4 Oct 16-22	10-5 Oct 23-29	Esc Est
MARBLE RIVER	Coho	243		349	280		301				664
CAYEGHLE SYSTEM	Coho		200	322		381	615	735			947

System	Species	9-1 Aug 28-Sep 3	9-2 Sept 4-10	9-3 Sept 11-17	9-4 Sept 18 24	10-1 Sept 25-Oct 1	10-2 Oct 2-8	10-3 Oct 9-15	10-4 Oct 16-22	10-5 Oct 23-29	Esc Est
MARBLE RIVER	Chum	0		0	3		0				
CAYEGHLE SYSTEM	Chum		97	*126*		*595*	*454*	1433			3,123

System	Species	9-1 Aug 28-Sep 3	9-2 Sept 4-10	9-3 Sept 11-17	9-4 Sept 18 24	10-1 Sept 25-Oct 1	10-2 Oct 2-8	10-3 Oct 9-15	10-4 Oct 16-22	10-5 Oct 23-29	Esc Est
MARBLE RIVER	Chinook	89		1122	*532*		*794*				1,606
CAYEGHLE SYSTEM	Chinook		186	153		*170*	126	145			398

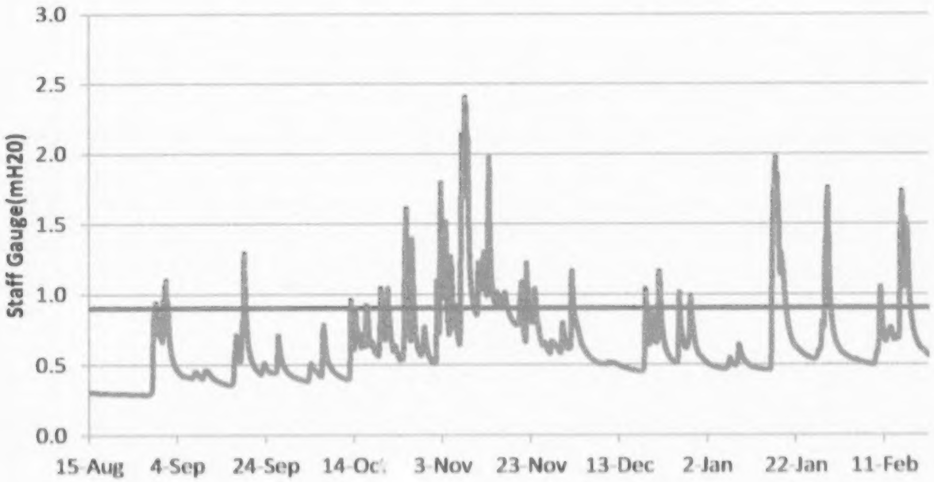


Figure 44-2. Kaouk River water levels Aug 15 – Feb 21; water levels above 0.9 m compromise survey quality.

Table 44-2. Area 26/27 escapement survey plan matrix for 2016.

Stat Area	First Nation Territory	Stream Name	September				October					November					December		Comments		
			9-1	9-2	9-3	9-4	10-1	10-2	10-3	10-4	10-5	11-1	11-2	11-3	11-4	11-5	12-1	12-2	Survey Type and Target	# Planned	# Done
26	Ka:'uy:'k'th'/ Che:k'tles7et'h'	AMAI CREEK																	PL+D: Chum/Coho		
26	Ka:'uy:'k'th'/ Che:k'tles7et'h'	ARTLISH RIVER	snkl	snkl	snkl	snkl	snkl	snkl	snkl		snkl								AUC: Chinook, chum, coho	8	6
26	Ka:'uy:'k'th'/ Che:k'tles7et'h'	CACHALOT CREEK																	PL+D: Chum/Coho		
26	Ka:'uy:'k'th'/ Che:k'tles7et'h'	CHAMISS CREEK																	PL+D: Chum/Coho		
26	Ka:'uy:'k'th'/ Che:k'tles7et'h'	Clanninick Creek																	PL+D: Chum/Coho		
26	Ka:'uy:'k'th'/ Che:k'tles7et'h'	EASY CREEK																	PL+D: Chum/Coho		
26	Ka:'uy:'k'th'/ Che:k'tles7et'h'	Elaine Creek																			
26	Ka:'uy:'k'th'/ Che:k'tles7et'h'	Upper JANSEN CREEK						snkl		snkl	snkl								SK-recon	3	2
26	Ka:'uy:'k'th'/ Che:k'tles7et'h'	KAOUK RIVER		snkl	snkl	snkl	snkl	snkl	snkl		snkl	snkl							AUC: Chinook, chum, coho	8	7
26	Ka:'uy:'k'th'/ Che:k'tles7et'h'	KASHUTL RIVER			snkl		snkl		CO snkl										PL+D: Chum/Coho (2 chum swims, 1 CO = 2 CM)	4	1
26	Ka:'uy:'k'th'/ Che:k'tles7et'h'	KAUWINCH RIVER			snkl		snkl	snkl		snkl									PL+D: Chum/Coho	4	1
26	Ka:'uy:'k'th'/ Che:k'tles7et'h'	Malksope River		snkl/t ag		snkl		snkl/t ag		snkl		snkl		snkl			snkl		AUC: coho with 2 tag days	10	5
26	Ka:'uy:'k'th'/ Che:k'tles7et'h'	NARROWGUT CREEK																	PL+D: Chum/Coho		
26	Ka:'uy:'k'th'/ Che:k'tles7et'h'	Ououkinsh River																			
26	Ka:'uy:'k'th'/ Che:k'tles7et'h'	Upper Power/Hisnit						snkl		snkl	snkl								SK-recon	3	
26	Ka:'uy:'k'th'/ Che:k'tles7et'h'	TAHSISH RIVER	snkl	snkl	snkl	snkl	snkl	snkl	snkl	snkl									AUC: Chinook, chum, coho	8	4
26	Ka:'uy:'k'th'/ Che:k'tles7et'h'	Yaku River																			
27	Quatsino	BENSON RIVER																			
27	Quatsino	CAYEGHLE SYSTEM	snkl	snkl	snkl	snkl	snkl	snkl	snkl	snkl									AUC: Chinook, chum, coho	8	5
27	Quatsino	LINK RIVER																			
27	Quatsino	MARBLE RIVER	snkl	snkl	snkl	snkl	snkl	snkl	snkl	snkl									AUC: Chinook, chum, coho	8	4

44.3. Escapement review meeting

The 2016 survey results from Area 26 and 27 were reviewed at a post-season escapement review workshop held at the Maritime Heritage Museum in Campbell River on February 22, 2017. Workshops participants (Table 44-3) reviewed and discussed the individual survey results and escapement estimates, then collaboratively filled in the commentary for each system that was surveyed. Participants also discussed quality of the observations and classified the estimates according to how they can be used for management purposes. Most of the commentary in the first section of each stream summary was derived from the stream narratives which have been completed by numerous surveyors over the past 20 years.

Table 44-3. Participants at the Area 26/27 escapement review workshop in Campbell River on February 22, 2017.

Participant	**Affiliation**
Keith Cox	KCFN
Frank Dragon	KCFN
Diana McHugh	DFO (Organizer)
Shane Johnson	LGL
Stephanie King*	Sea This Consulting (Organizer)
Stacey Larsen	Community advisor
Andrew Pereboom	DFO North Island Stock Assessment
Carole Perrault	Quatsino Fisheries Coordinator, Quatsino First Nation
Tony Hansen	KCFN
Lorraine Landry	Quatse River Hatchery/Northern Vancouver Island Salmonid Enhancement

* via phone

45. KAOUK RIVER

45.1. Stream Summary

The Kaouk River flows west into the head of Fair Harbour in Kyuquot Sound. There are campground and a marina to the south of the estuary. The system is over 20 km in length and is fed by many small tributaries and surrounding mountains. The largest tributary is Rowland Creek which enters the Kaouk about 7.5 km upstream (Marker 15; Figure 45-1). Spawner surveys cover 8.5 km in the lower river, in 17 - 500 m survey sections. The survey starts just above the bridge at marker 17. The upper survey sections are primarily pool and riffle habitats with gravels and cobble as the most common substrates as well as some boulders. In the lower portion, the habitat has all meso-habitat features, but is primarily composed of riffle and glide habitats. The substrate is mostly composed of cobbles and boulders. There is suitable rearing and spawning habitat throughout the survey area.

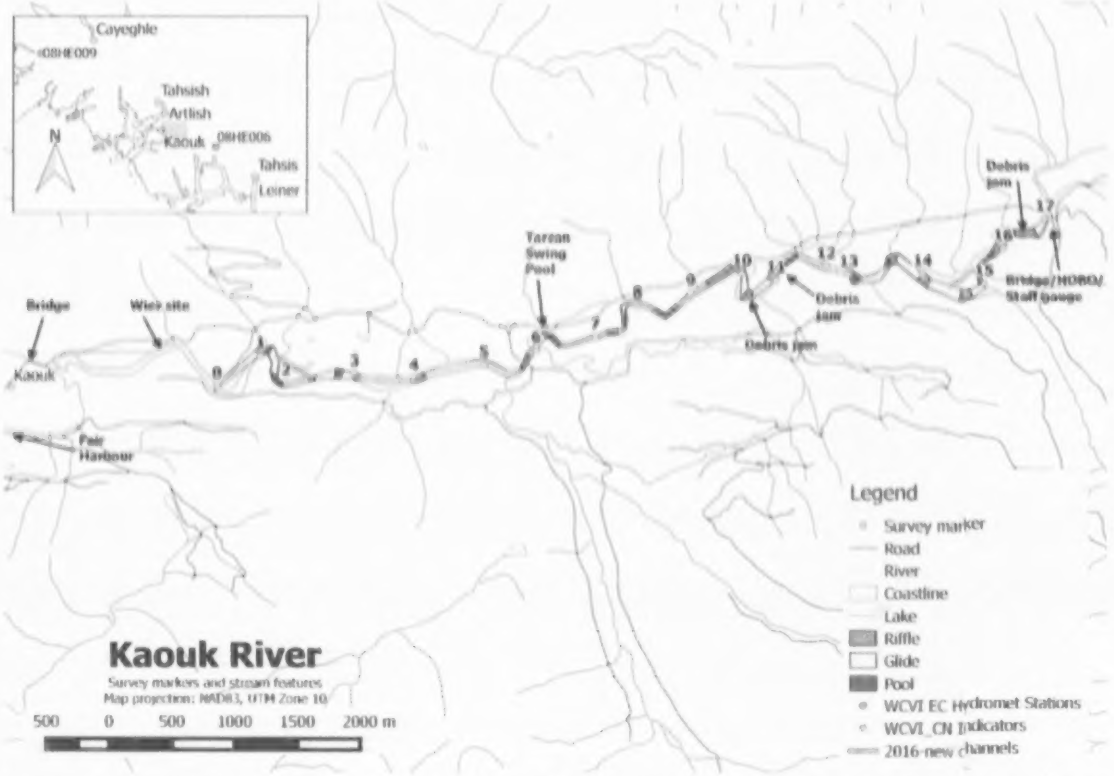

Cayeghle
08HE009
Tahsish
Artlish
N
Kaouk
08HE006
Tahsis
Leiner
Debris jam
17
16
Bridge/HOBO/ Staff gauge
15
14
13
12
11
10
Debris jam
Debris jam
9
8
7
Tarzan Swing Pool
6
5
4
3
2
1
0
Bridge
Wier site
Kaouk
Fair Harbour
Kaouk River
Survey markers and stream features
Map projection: NAD83, UTM Zone 10
500
0
500
1000
1500
2000 m
Legend
Survey marker
Road
River
Coastline
Lake
Riffle
Glide
Pool
WCVI EC Hydromet Stations
WCVI_CN Indicators
2016-new channels

Figure 45-1. Kaouk River counting stations and habitat units. Map inset shows the locations of other systems that are regularly surveyed in the area as well as the location of the Environment Canada hydromet stations on the Zeballos River near Zeballos (08HE006) and on the Klaskish River near Klaskino Inlet (08HE009). Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. Habitat data were mapped in the field and / or digitized from recent high resolution orthophotographs by M.C. Wright and Associates Ltd.

There are several deep pools including those at marker 6, markers 10 and between markers 11 and 12. Historically, there was also a bridge below markers 6. The abutments still remain and the bridge was replaced by hydro lines which now cross the system. A counting fence was installed in 2009. The fence was washed out, but the weir footings still remain.

There is a lot of wood and debris in the system. In recent years erosion has been noted in many locations of the system, especially around markers 16 and 17, and pools have been filling in. The sections downstream of marker 6 have a lower gradient and tend to be more stable.

The Kaouk discharge is described as flashy; the water can increase by more than 2 meters in a day. Surveyors comment that that the water clarity is good, but that compared to the nearby Artlish River the Kaouk is generally more turbid and also takes longer to clear. As with many other systems on the west coast of Vancouver Island, the water clarity deteriorates quickly with increasing flow after rain events. In 2014, DFO installed a hydrometeorological monitoring station at survey marker 17 on the Kaouk. The Environment Canada monitoring station on the Zeballos River (08HE006), about 20 km to the east-southeast of the mouth, is also a good indicator of flow on the Kaouk.

There is a relatively large seal population in the estuary and locals are concerned about the impact on returning Chinook. The seal population is largest when the salmon are holding in the estuary prior to the first large rain event.

Logging has been absent from the watershed for ~8 years. The steep mountains have obvious signs of both conventional and helicopter logging activities. The upper Kaouk watershed has been extensively logged in the recent past.

45.2. Survey Results and Escapement Estimate

Survey Crew: NVISEA, KCFN/LGL
Stock Assessment Biologist: D. McHugh

Survey Data:

Table 45-1. Unexpanded live (L) and dead (D) counts by species for each survey, peak live plus dead (PL+D) raw and expanded for OE. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:
For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%; For CM - Excellent = 90%, Good = 90%, Fair = 80%, Poor = 80%

			SK		CO		PK		CM		CN	
Date	**OE cat.**	**Comments**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**
06-Sep	good	Water level below normal (0.42m), tea. Horizontal vis 12.2m, vertical vis 6m	40		344		1		14		213	
15-Sep	excellent	Water level normal (0.48m), clear. Horizontal vis 12m, vertical vis to bottom.	40		612				27		215	
22-Sep	excellent	Water level below normal (0.43m), slightly turbid. Horizontal vis 12m, vertical vis to bottom.	34		1230				173		201	1
29-Sep	excellent	Water level normal (0.44m), slightly turbid. Horizontal vis 12m, vertical vis to bottom.	20		1283		0		412	2	182	1
05-Oct	excellent	Water level extremely low (0.39m), clear. Horizontal vis 11m, vertical vis 8.5m.	20		1570				1210	7	141	1
12-Oct	excellent	Water level above normal (0.585m), slightly turbid. Horizontal vis 11m, vertical vis to bottom.	22		1205	1			1309	13	62	4
29-Oct	excellent	Water level normal (0.48m), clear. Horizontal vis-14-15, vertical vis to bottom.	9		1735	3			3130	503	32	
14-Dec	good	Water level below normal (0.42m), tea. Horizontal vis 12.2m, vertical vis 6m			221	11						
		Raw PL+D	40		1,738		1		3,633		215	
		Exp PL+D	44		2,674		1		4,541		239	

Table 45-2. Survey life (SL), adult escapement estimate and rational how the method was applied. Escapement estimates use the OE described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Sp.	**SL**	**First Zero**	**Last Zero**	**Annual escapement estimate**	**Analytical method**	**Data quality level**
SK	35 (30-40)	Sep 1	Nov 15	50 (44-59)	Expanded Area Under the Curve	2
CO	40 (35-45)	Sep 1	Dec 20	3656 (3250-4178)	Expanded Area Under the Curve	2
PK	NA			1	Expanded Peak Live + Dead	3
CM	15 (10-20)	Sep 1	Nov 15	6492 (4869-9737)	Expanded Area Under the Curve	3, may have missed the peak
CN	25 (20-30)	Sep 1	Nov 15	370 (308-463)	Expanded Area Under the Curve	2

Escapement Commentary:

SK return:	Less than the 12 year average (~70)
CO return:	Above the 12 year average (~2300), individuals were larger than average
PK return:	
CM return:	Less than the 12 year average (~8800), wet year compromised survey coverage, lots of morts, may have missed the peak based on adjacent system
CN return:	Similar to the 12 year average (~320)

45.3. Spawner Distribution

Run Timing:

Table 45-3. The run timing for the survey year by species.

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye					Mid Sept	Early Oct	
Coho					Late Sept		
Pink							
Chum					Late Sept	Mid to Late Oct	Late Oct
Chinook					Early Sept	Late Sept	Early Oct

Spatial Distribution:

Table 45-4. The survey sections used by spawners per species.

Species	Survey Section(s) used for spawning
Sockeye	17-16, 15-14, 10-9,4-3, 1-0
Coho	17-2
Pink	Unknown
Chum	17-0
Chinook	15-0

Comments: This is typical of this watershed.

45.4. Environmental Conditions

Weather Summary: Conditions were conducive to migration starting early Sept. Poor survey conditions in October, November.

Physical Characteristics Update: Section 17-16: Large woody debris (LWD) and gravel movement ~150m downstream of the mainline bridge formed a log jam.

Due to major rain events in Nov of 2016, the river had several areas of bedload and LWD movement throughout the survey. Several pools were filled in with gravel and LWD cover was lost.

River cuts through a side channel and bypasses the #15 marker. In section 3-2, 200m below the 3 marker the river has cut a new channel and only 10-20% of the flow remains in the old channel.

45.5. Update to Stream Survey Protocols

Current Assessment Method: The 8.5 km snorkel survey is conducted by two or more surveyors, swimming downstream parallel to each other looking for adult salmon in the centre of the channel. It takes approximately four hours from the start of the survey and back. Water temperature, discharge, staff gauge height and horizontal visibility were measured during the surveys.

Deviations from current assessment protocols: None reported.

Access Updates: Access is via the Fair Harbour main logging road by vehicle. The bridge over the Kaouk River at the 10 km marker is the survey start access point, and also where the HOBO site is located. Access to river section 14-13 is can easily be accessed by following the creek at 9km marker on Fair Harbour Main down to the river. The Fair Harbour Main fallows the river and at several point the river is visible and accessible from the main road. The mid-point of the survey, just above river marker 6, also known as the swimming pool or Tarzan swing pool is probably one of the easiest and best known access points. This is located at approximately 5.5 km on the Fair Harbour Mainline. Below river marker 6, there is little access to the river. Access to the end of survey point, marker 0, is via an old road off the Fair Harbour Mainline at approximate 2.5 km. There are some ribbons at the road entrance, but the road is still easy to miss. There is also good access to the river at the old counting fence site. There is a big yellow gate with a short road that ends at a high bank overlooking the river. There is a trail down to the river, but is becoming overgrown as the trail and site is not being used.

The Kaouk River was accessed by boat from the Kyuquot Village (approximately a 45 minute run) and then by road. A driver dropped off the swim crew at the start point of the survey (Fair Harbour mainline bridge) and then picked them up at a spur road near marker 0 (50°4'0.54"N; 127°4'58.60"W)

Safety Update: Lots of bears on the river.

45.6. Enhancement

No known hatchery, enhancement or restoration activities.

45.7. Biosamples

Four biosamples were collected by the escapement crew. One female, three males, of the three otoliths that were readable, all three were unmarked.

45.8. Concerns and Comments

- High bedload movement, new channels, pools filling in
- Marker 11 log jam blown out in 2015 and is now filling in.

46. ARTLISH RIVER

46.1. Stream Summary

The Artlish River flows west into Tahsish Inlet in Kyuquot Sound (Figure 46-1). The Artlish River is a typical west coast Vancouver Island stream fed by many small, unnamed tributaries from the surrounding mountains. The mainstem length is over 25 km. The watershed consists of steep terrain except for the lower 8 km which has a relatively low gradient. There is a barrier to salmon migration at 15 km upstream from the mouth.

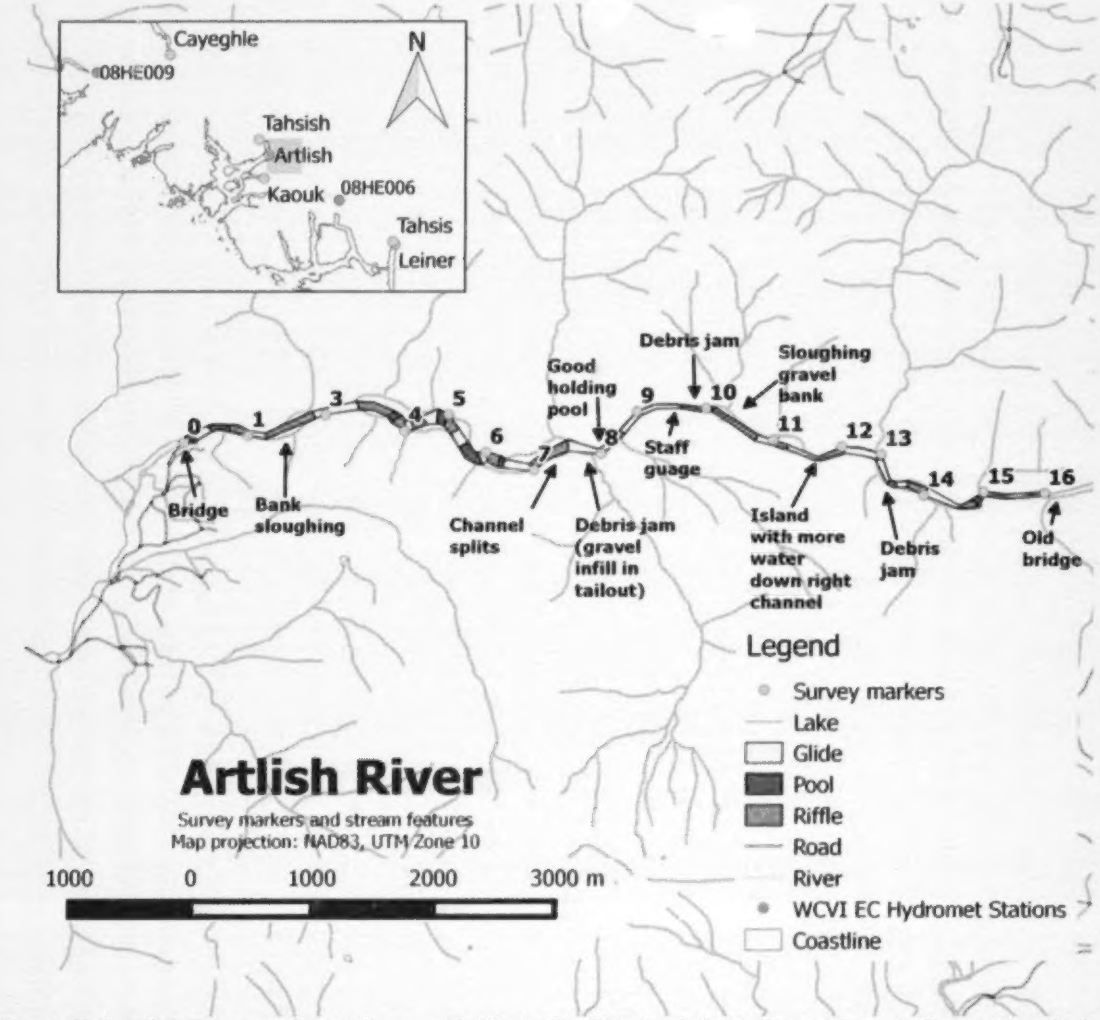

Cayeghle
08HE009
N
Tahsish
Artlish
Kaouk
08HE006
Tahsis
Leiner
Good holding pool
Debris jam
Sloughing gravel bank
0
1
3
4
5
6
7
8
9
10
11
12
13
14
15
16
Bridge
Bank sloughing
Channel splits
Debris jam (gravel infill in tailout)
Staff guage
Island with more water down right channel
Debris jam
Old bridge
Legend
Survey markers
Lake
Glide
Pool
Riffle
Road
River
WCVI EC Hydromet Stations
Coastline
Artlish River
Survey markers and stream features
Map projection: NAD83, UTM Zone 10
1000
0
1000
2000
3000 m

Figure 46-1. Artlish River counting stations and habitat units. Map inset shows the locations of other systems that are regularly surveyed in the area as well as the location of the Environment Canada hydromet stations on the Zeballos River near Zeballos (08HE006) and on the Klaskish River near Klaskino Inlet (08HE009). Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. The logging road running the length of the system is not shown. Habitat data were mapped in the field and / or digitized from recent high resolution orthophotographs by M.C. Wright and Associates Ltd. Debris jam locations are approximate and as reported in 2016.

This lower 8 km has been divided into 16 - 500 m sections for conducting escapement surveys. The upper survey sections include all meso-habitat features, but are primarily composed of pool and riffle habitats. There are several avulsions as well. All substrates types are present in the upper sections, but most common are gravel and cobble with some boulders. In the lower survey sections, the habitat includes all meso-habitat features, but is primarily composed of riffle and glide habitats. The substrate is gravel and cobble. In recent years, surveyors have reported an overall increase in gravel in the system. There is both rearing and spawning habitat throughout the 8 km survey area.

Large woody debris jams are common on the Artlish and divert flow in some sections. There is a constant influx of new wood into system and frequent movement of jams. Pools below marker 15 and above 10 are about 3 to 4 m in depth and are considered good holding pools. However, there have been observations of pools filling in in recent years.

Flow on the nearby Kaouk River is a good indicator for conditions on the Artlish River. With the influx of gravel into the system, local experts suggest that more of the river flow has become subsurface in recent years.

Water clarity in the Artlish is usually excellent except after heavy precipitation. Surveyors often measure horizontal visibility with a Secchi disc at over 12 m. Water clarity decreases with rain events and the system takes 3 to 5 days return to normal conditions. Surveyors generally note high observer efficiency on the Artlish due to its excellent water clarity and a channel with low complexity.

The river banks have become increasingly unstable in recent years with heavy erosion in some sections. In 2012, a landslide between markers 5 and 6 deposited some large boulders in the system. Poor road maintenance has led to periodic increases to sediment input into the river. Surveyors have reported a large amount of bedload movement in recent years.

46.2. Survey Results and Escapement Estimate

Survey Crew: NVISEA/KCFN-LGL
Stock Assessment Biologist: D. McHugh

Survey Data:

Table 46-1. Unexpanded live (L) and dead (D) counts by species for each survey, peak live plus dead (PL+D) raw and expanded for OE. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories: For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%; For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

			SK		CO		PK		CM		CN	
Date	**OE cat.**	**Comments**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**
08-Sep	Excellent	Water level below normal (0.16m), water clear. Horizontal vis 19.5m, vertical vis 5.75m	8		71				9		114	
15-Sep	Excellent	Water level extremely low (0.32m), water clear. Horizontal vis 25m, vertical vis 5.5m	9		128		1		20		121	
22-Sep	Excellent	Water level below normal (0.5m), water clear. Horizontal vis 17.5m, vertical vis 10m	6		400	1	1		160		86	
29-Sep	Excellent	Water level normal (0.425m), water clear. Horizontal vis 21.3m, vertical vis 11m	9		231		1		425	3	85	1
05-Oct	Excellent	Water level below normal (0.38m), water clear. Horizontal vis 20.7m, vertical vis 9.5m	7		288		1		253	29	67	1
18-Oct	Fair	Water level above normal (0.86m), water slightly turbid. Horizontal vis 8.7m, vertical vis 7.5m			291				2894	11	4	1
01-Nov	Good	Water level normal (0.59m), water clear. Horizontal vis 15.6-16.1m, vertical vis to bottom.			728	3			4398	9962	6	1
		Raw PL+D	9		731		1		14,360		121	
		Exp PL+D	10		914		1		15,956		134	

Table 46-2. Survey life (SL), adult escapement estimate and rational how the method was applied. Escapement estimates use the OE described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Sp.	SL	First Zero	Last Zero	Annual escapement estimate	Analytical method	Data quality level
SK	25 (20-30)			12 (10-15)	Expanded Area Under the Curve	Level 2
CO	35 (30-40)	Sept 1	Dec 1	963(843-1124)	Expanded Area Under the Curve	Level 2
PK	NA			1	Expanded Peak Live + Dead	Level 2
CM				15965	Expanded Peak Live + Dead	Level 2
CN	25 (20-30)	Sept 1	Nov 15	166 (138-207)	Expanded Area Under the Curve	Level 2

Escapement Commentary:

SK return: Similar to the 12 year average (~15)

CO return: Less than the 12 year average (~1400), there were some large coho (bigger than the chinooks, a lot of average size, and a lot of jacks.

PK return:

CM return: Above the 12 year average (~4700), there were so many dead chum (counting totes (~1000) of dead chum at the bottom end. There is some uncertainty about how deep the dead were so the dead estimate is uncertain.

CN return: Less than the 12 year average (~280)

46.3. Spawner Distribution

Run Timing:

Table 46-3. The run timing for the survey year by species.

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye							
Coho					Late Sept		
Pink							
Chum					Mid Sept	Late Sept	Early Oct
Chinook					Mid Sept	Late Sept	Mid Oct

Spatial Distribution:

Table 46-4. The survey sections used by spawners per species.

Species	Survey Section(s) used for spawning
Sockeye	14-13,6-5
Coho	
Pink	
Chum	7-6, 5-0
Chinook	15-13,11-10, 8-7, 1-0 (distribution of biosamples is an indication of spawning location)
Steelhead	

46.4. Environmental Conditions

Weather Summary:

Physical Characteristics Update:

- Braiding in Section 12-11, the stream splits into two channels, more flowing in right channel as of Nov 2016 (has been switching back and forth between the two channels) the log jam at the head of that island is gone.
- The last two years have seen large changes.
- In 2015, at Marker 13 a lot of substrate was coming in from that tributary.
- Above marker 13, a large debris jam used to hold fish was washed out in 2016
- Logs at Marker 4, lower logs gone.
- Log at Marker 1 is gone.

46.5. Update to Stream Survey Protocols

Current Assessment Method:

An 8.0 km snorkel survey is conducted by two or three surveyors, swimming downstream parallel to each other looking for adult salmon in the centre of the channel. It takes approximately four hours from the start of the survey to the estuary. Water temperature and horizontal visibility were measured during the survey. The staff gauge is located between markers 9 and 10.

Deviations from current assessment protocols:

None reported

Access Updates:

Access to the Artlish River from highway 19 is via the Zeballos Main, Atluck Main and then the Artlish Main. River access is to the survey start point at marker 16 is via an old deactivated road that is flagged. The mid river access/check in point is between river markers 10-9. Staff gauge and discharge site are located at the mid river point. The survey exit point is at the Artlish mainline bridge down at the estuary. Exit the river on river right, there is a long rope to aid climbing the steep bank up to the bridge deck.

Access to the Artlish River involved, traveling on a gravel road for ~50 km along the Artlish Mainline Road. The survey crew was dropped off at an old spur road, near marker 16. The crew used the spur road to access the river on right bank. The driver waited between marker 9 and 10 for the crew to swim past and then met them at the mainline bridge, near the estuary. In 2013, there was active logging in the area, which improved road conditions

Safety Update:

46.6. Enhancement

No known hatchery, enhancement or restoration activities.

46.7. Biosamples

4 biosamples were collected by the NVISEA crew. There were three males and one female. One of the males was from an early seapen release from Conuma, the others were unmarked.

46.8. Concerns and Comments

We may want to get an extended survey (up to the caves ~ Marker 30) during the peak of Chinook to evaluate how many may be spawning above the survey section.

There is an interest in getting Sockeye biosamples (DNA) – want to know if the sockeye seen in the river are local or from Fraser or Somass. But we don't usually see morts so sampling will likely be difficult.

Emphasize importance of dead counts, look on the banks were chum morts wash up, or you'll miss them.

Andrew Pereboom updated the survey marker position this year

47. MALKSOPE RIVER

47.1. Stream Summary

Flows southwest into head of Malksope Inlet, to the northwest of Kyuquot Sound. The mainstem length is 10 km and the lower 5.6 km is surveyed in eleven 500 m sections (Figure 47-1). The survey starts at marker 11 which is also at the lower end of a canyon which is a barrier to anadromous fish (Figure 47-2). Historically, the survey started about 150 m downstream from the current starting point.

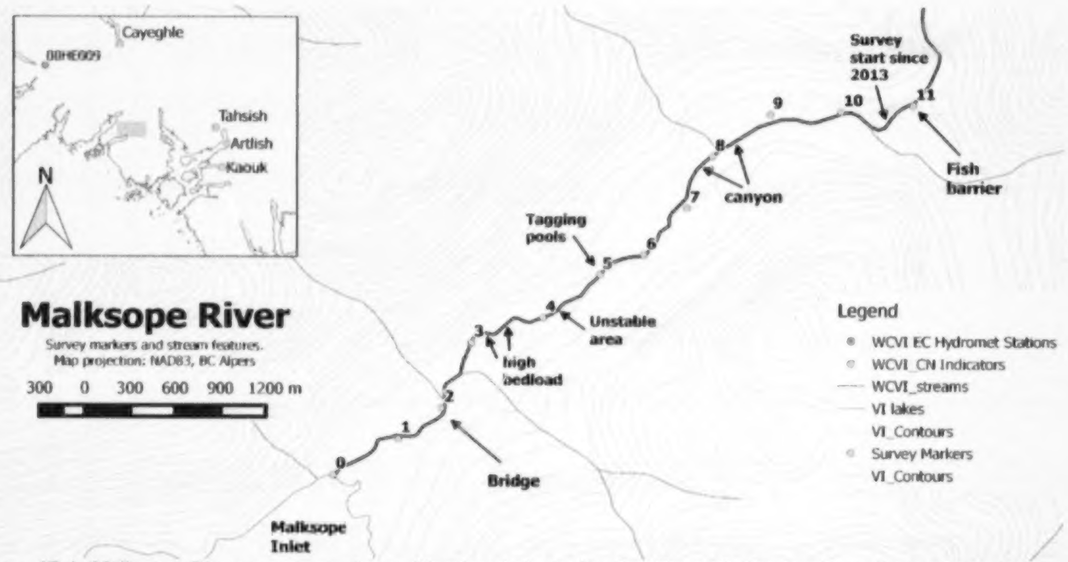

Cayeghle
08HE009
Tahsish
Artlish
Kaouk
N
Malksope River
Survey markers and stream features.
Map projection: NAD83, BC Alpers
300 0 300 600 900 1200 m
Survey start since 2013
9
10
11
Fish barrier
8
canyon
7
Tagging pools
6
5
4
Unstable area
3
high bedload
2
1
0
Bridge
Malksope Inlet
Legend
WCVI EC Hydromet Stations
WCVI_CN Indicators
WCVI_streams
VI lakes
VI_Contours
Survey Markers
VI_Contours

Figure 47-1. Malksope River survey markers. Map inset shows the locations of other systems that are regularly surveyed in the area as well as the location of the Environment Canada hydromet stations on the Zeballos River near Zeballos (08HE006) and on the Klaskish River near Klaskino Inlet (08HE009). Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia.

The upper survey area is characterized by pool and riffle habitats with some runs and glides. All substrate types are present but cobble, boulder and bedrock predominate upstream of marker 7. There is a second canyon from above marker 8 to below marker 8.

In the lower portion the habitat consists primarily of riffles, there are several glides, pools and runs. Below marker 8 there is abundant rearing and spawning habitats for all species. The vast majority of Chum spawn below marker 8. Malksope is predominately a Chum and Coho salmon stream with some Chinook and Sockeye salmon. A significant tributary enters from river left about 200 m below marker 3. The system is used as a Coho indicator stream.

There is a lot of wood in the river and high bedload movement. The watershed has been extensively logged, not so much lately. There have been several Coho tagging studies in recent years.

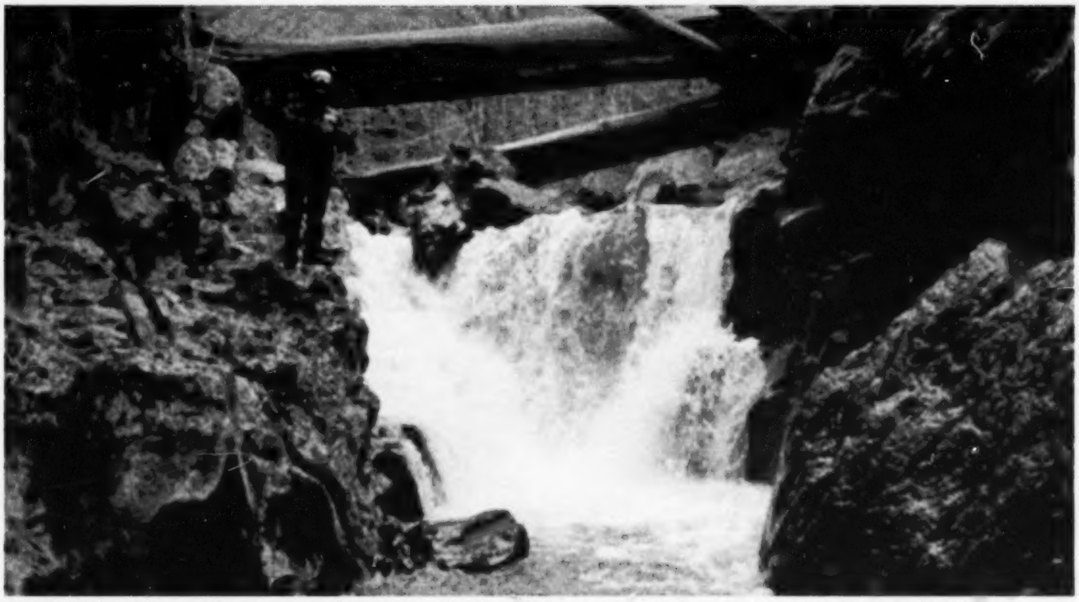


Figure 47-2. Looking upstream at the Malksope River anadromous barrier at marker 11 (photo credit: Shane Johnson, November 11, 2014).

47.2. Survey Results and Escapement Estimate

Survey Crew: KCFN (Keith Cox, Tyler Hanson), LGL (Shane Johnson)
Stock Assessment Biologist: D. McHugh

Survey Data:

Table 47-1. Unexpanded live (L) and dead (D) counts by species for each survey, peak live plus dead (PL+D) raw and expanded for OE. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:
For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%; For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

			SK		CO		PK		CM		CN	
Date	**OE cat.**	**Comments**	**L**	**D**	**L**	**D**	**L**	**D**	**L**	**D**	**L**	**D**
21-Sep	Excellent	Water level normal (0.980m), and clear. Horizontal vis 13m, vertical vis to bottom.	9		563	1	1		154		5	
01-Oct	Excellent	Water level normal (0.960m), and clear. Horizontal vis 14m, vertical vis to bottom.	9		809				634		4	
06-Oct	Excellent	Water level normal (0.940m), and clear. Horizontal vis 14m, vertical vis to bottom.	10		906		1		1400		2	
31-Oct	Good*	Water level above normal (1.5m), and slightly turbid. Horizontal vis 13m, vertical vis to bottom.	1		867				1247	277	4	
		Raw PL+D	10		906		1		1,524		5	
		Exp PL+D	12		1,084		1		1,693		6	

*Conditions were ideal, but due to higher water levels, a section (~250m from anadromous barrier to falls pool) could not be effectively surveyed, too turbulent. In the previous survey, ~200 CO were in that section.

Table 47-2. Survey life (SL), adult escapement estimate and rational how the method was applied. Escapement estimates use the OE described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Sp.	**SL**	**First Zero**	**Last Zero**	**Annual escapement estimate**	**Analytical method**	**Data quality level**
SK				12	Expanded Peak Live + Dead	2
CO	35 (30-40)	Sep 1	Dec 1	1759 (1539-2052)	Area Under the Curve	2
PK	NA			1	Expanded Peak Live + Dead	2
CM	15 (10-20)	Sep 1	Nov 15	3934 (2951-5901)	Expanded Area Under the Curve	3
CN	20 (15-25)	Sep 1	Nov 15	13 (10-17)	Expanded Area Under the Curve	2

47.3. Escapement Commentary:

SK return: There was a higher abundance of Sockeye in 2015 (5) then in 2014 (1).

CO return: There was a lower abundance of Coho in 2015 (peak count 1110) then in 2014 (1501). In 2015, there were a large % of jacks and the adult Coho Salmon were smaller than in the past years.

PK return: There was a higher abundance of Pink in 2015 (4) then in 2014 (0). This was the first time Pink Salmon were observed by Shane Johnson (LGL) since starting in Area 26 in 2012.

CM return: There was a lower abundance of Chum in 2015 (peak count 3007) then in 2014 (5559).

CN return: There was a higher abundance of Chinook in 2015 (11) then in 2014 (6).

47.4. Spawner Distribution

Run Timing:

Table 47-3. The run timing for the survey year by species.

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye					Late Sept	Mid Oct.	Early Nov.
Coho					Late Sept	Late Oct.	Early Dec.
Pink					Late Aug.	Mid Oct.	Early Nov.
Chum					Late Sept	Early Oct	Late Oct
Chinook					Late Sept	Mid Oct.	Early Nov.

Spatial Distribution:

Table 47-4. The survey sections used by spawners per species.

Species	Survey Section(s) used for spawning
Sockeye	Marker #7 to 5
Coho	Marker #11 to 2
Pink	Marker #5 to 3
Chum	Marker #6 to 0- less spread out than in 2015
Chinook	Marker #11 to 10
Steelhead	Unknown

Comments: This is typical of this watershed

47.5. Environmental Conditions

Weather Summary:

Physical Characteristics Update: Some LWD and gravel movement has occurred during the previous winter.

47.6. Update to Stream Survey Protocols

Current Assessment Method:

A 5.5 km snorkel survey is conducted by two or more surveyors, swimming downstream parallel to each other looking for adult salmon in the centre of the channel. It takes approximately four hours from the start of the survey to the end. Water temperature, discharge, staff gauge height and horizontal visibility were measured during the surveys.

Deviations from current assessment protocols:

Coho tagging was not sufficient to get a SL estimate due to poor weather conditions.

Access Updates:

The Malksope River was accessed by road from Kyuquot Village (approximately 50 minutes). In 2016, a driver dropped off the swim crew at the upper access trail (50° 9'40.33"N; 127°21'55.75"W), upstream of marker 11. The crew would then hike through the forest on left bank, along a flagged trail and end up ~10 m upstream of the anadromous barrier (Photo 1). The crew would then swim down the margins of the river and climb down the falls on the right bank side and start the survey at the base of the falls. Upon completing the survey, the crew walked upstream from marker 0 to marker 1, and get picked up on the Malksope Mainline road. Historically, the survey has been divided into two portions, with one crew surveying the upper portion of the reach (markers 11 to 6) and the other crew surveying the lower portion of the reach (markers 6 to 0). If time is an issue, it is recommended to divide the survey into two portions.

The road out to Malksope, there was some grading prior to the big rain event, road access may be an issue. The road hasn't been checked since.

Safety Update:

Conditions at staff gauge have changed, there is a backwater, so a reading of .98m is good, whereas a 1m reading in 2015 would have not been swimmable.

47.7. Enhancement

No hatchery activities.

47.8. Biosamples

47.9. Concerns and Comments

- Intensive forestry activities has taken place of both sides of Malksope River and could be the reason for increased water transport, resulting in bedload movement. In reach 5-4, there is high bedload movement and instability. This would be an ideal location for gravel bar enhancement and riparian releases.

- There were extensive habitat rehabilitation works in the mid-1990s, but the main channel has not stabilised.
- Widening the road to do some forestry in the Clanninick watershed.
- In the last two years, the Coho have been going straight up to the falls, not holding in the lower pools as much as in a few years ago. Tried to catch Coho for tagging in a new pool this year (Reach 5) had lots of fish last year but not in 2016.
- Some bedload movement, but nothing major as of 11-1.
- A few Chum came in early (were post-spawn in late Sept), then another pulse came in later on.
- Note change at the staff gauge described in the safety update above.

48. TAHSISH RIVER

48.1. Stream Summary

The Tahsish River flows south into head of Tahsish Inlet, in Kyuquot Sound. The lower river is located in the Tahsish-Kwois Provincial Park. The mainstem is 29 km long, but the most suitable spawning habitat and area surveyed is found in the lower 6 km. The Tahsish River is fed by many small tributaries, snow pack and several small lakes. About 6 km upstream from the estuary there is a canyon where the steam's gradient becomes very steep. It is considered a barrier to fish under most conditions. Historically, the lower 6 km was divided into 12 survey sections, each about 500 m apart, but there have been no survey markers on the system in recent years and marker locations are approximate (Figure 48-1).

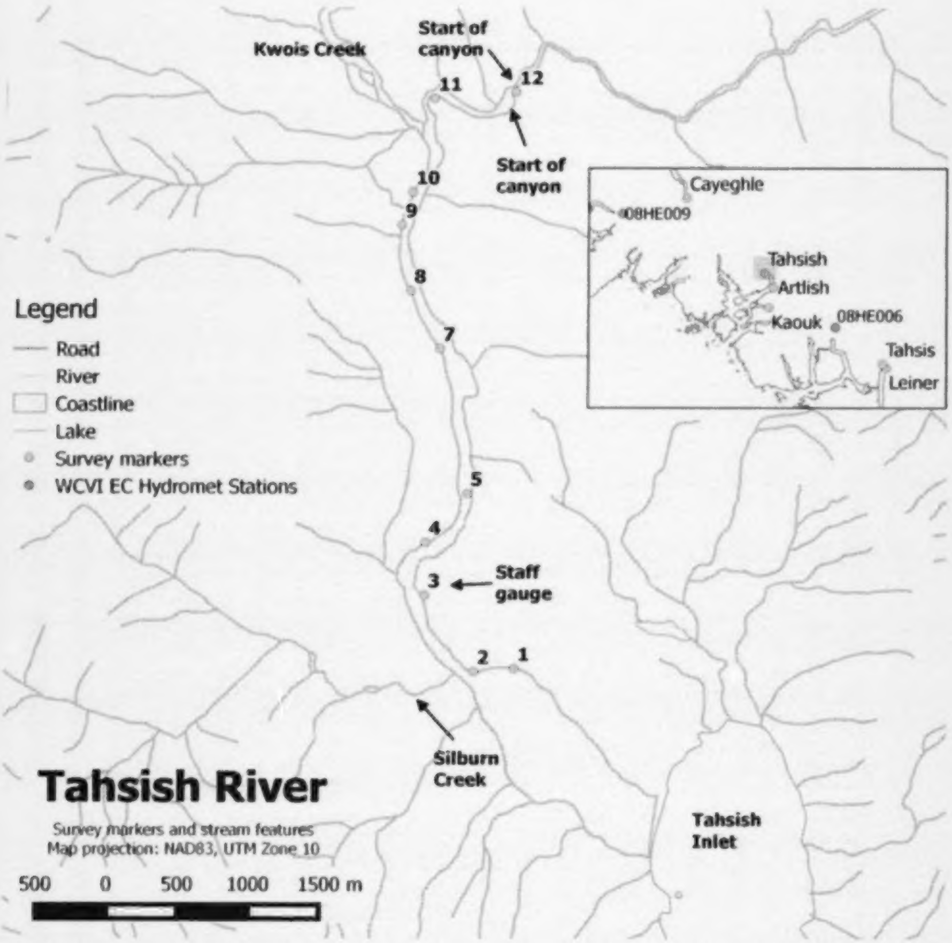

Kwois Creek
Start of canyon
11
12
Start of canyon
10
9
8
7
5
4
3
Staff gauge
2
1
Silburn Creek
Tahsish Inlet
Cayeghle
08HE009
Tahsish
Artlish
Kaouk
08HE006
Tahsis
Leiner
Legend
Road
River
Coastline
Lake
Survey markers
WCVI EC Hydromet Stations
Tahsish River
Survey markers and stream features
Map projection: NAD83, UTM Zone 10
500
0
500
1000
1500 m

Figure 48-1. Tahsish River counting stations. Map inset shows the locations of other systems that are regularly surveyed in the area as well as the location of the Environment Canada hydromet stations on the Zeballos River near Zeballos (08HE006) and on the Klaskish River near Klaskino Inlet (08HE009). Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. Survey markers are approximate and based on historical locations.

Kwois Creek is the largest tributary and enters the Tahsish between markers 10 and 11. Another tributary, Silburn Creek, enters Tahsis about 1 km up from the mouth. There have been observations of Coho in both tributaries. Most of the survey area has a low gradient with a variety of meso-habitats throughout. In the upper survey sections, the habitat is primarily pools and glides and there are a range of substrate types including bedrock at the top of the survey area. The lower survey sections are primarily riffle and glide habitats and the substrate mostly gravel and cobble. Between markers 0 and 1 the stream splits into two channels. There is both rearing and spawning habitat throughout the 6 km survey area.

There is a large pool at the base of the canyon, above survey marker 12, and deep enough that surveyors cannot see the bottom on swim surveyors. The Tashish has moderate water clarity, particularly in comparison to nearby systems such as Kaouk and Artlish. The discharge is comparatively higher, and water clarity is made worse by ongoing forestry in the area above the canyon. Kwois Creek generally has high tannins and has been reported to contribute considerable gravel to the system in recent years.

48.2. Survey Results and Escapement Estimate

Survey Crew: NVISEA, KCFN, LGL
Stock Assessment Biologist: D. McHugh

Survey Data:

Table 48-1. Unexpanded live (L) and dead (D) counts by species for each survey, peak live plus dead (PL+D) raw and expanded for OE. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories: For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%; For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

			SK		CO		PK		CM		CN	
Date	**OE cat.**	**Comments**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**
09-Sep	Excellent	Water level below normal 0.32m, and tea. Horizontal vis 12m, vertical visibility 6m	8		192		3		11		331	
28-Sep	Fair	Water level normal 0.59m, and tea. Horizontal vis 7.2m, vertical visibility 9m	21		873	2			720		196	2
06-Oct	Excellent	Water level below normal 0.28m, and tea. Horizontal vis 9.5m, vertical visibility 8.5m	17	1	591	1			757	22	160	3
31-Oct	Fair	Water level above normal 0.73m, and slightly trubid. Horizontal vis 7m, vertical visibility 6.5m	3		474				1017	411	11	
		Raw PL+D	21		875		3		1,428		331	
		Exp PL+D	32		1,346		3		1,785		368	

Table 48-2. Survey life (SL), adult escapement estimate and rational how the method was applied. Escapement estimates use the OE described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Sp.	**SL**	**First Zero**	**Last Zero**	**Annual escapement estimate**	**Analytical method**	**Data quality level**
SK	30 (25-35)	1-Sep-15	15-Nov-15	32 (27-38)	Expanded Area Under the Curve	2
CO	35 (30-40)	1-Sep-15	15-Nov-15	1,327 (1,161-1,548)	Expanded Area Under the Curve	2
PK	NA			3	Expanded Peak Live + Dead	3
CM	15 (10-20)	1-Sep-15	15-Nov-15	3,441 (2,581-5,162)	Expanded Area Under the Curve	3
CN	20 (15-25)	1-Sep-15	15-Nov-15	615 (492-821)	Expanded Area Under the Curve	2

Escapement Commentary:

SK return:	Less than the 12 year average (~80)
CO return:	Less than the 12 year average (~2700)
PK return:	Less than the 12 year average (~3)
CM return:	Less than the 12 year average (~5500), but we may have missed the peak
CN return:	Above the 12 year average (~325)

48.3. Spawner Distribution

Run Timing:

Table 48-3. The run timing for the survey year by species.

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye							
Coho				Late Aug.			
Pink							
Chum				Mid Sep.			Late Oct
Chinook							Late Oct

Spawning not observed

Spatial Distribution:

Table 48-4. The survey sections used by spawners per species.

Species	Survey Section(s) used for spawning
Sockeye	
Coho	
Pink	
Chum	11-3
Chinook	12-11, 10-3
Steelhead	Unknown

Comments:

48.4. Environmental Conditions

Weather Summary:

Physical Characteristics Update:	Compared to 2015, the Marker 7-3, river braided and changes from river left to river right.

48.5. Update to Stream Survey Protocols

Current Assessment Method:

Deviations from current assessment protocols: Crew swam down to Marker 2 (a bit tidal, but a lot of Chum spawn down there).

Access Updates:

Safety Update:

48.6. Enhancement

No known hatchery, enhancement or restoration activities.

48.7. Biosamples

29 samples were collected (5 females and 24 males). 10 originated in Conuma Hatchery, the rest were unmarked.

48.8. Concerns and Comments

Fish guiding is ongoing on the Tahsish River each fall targeting Coho salmon. Some wood has been cut in river to allow jet boat access up the river. The amount of cutting is minimal, and not likely to any effect on river course or erosion.

There is a staff gauge near swim marker 4, but the river has shifted and only a portion of the river runs past the staff gauge location. It may be worth the time, effort and money to helicopter in on the first 2017 snorkel survey to get this set up. There may be a slight increase in cost to have the helicopter pick up the person installing the staff gauge at the end of the swim. I believe there is a good spot in the canyon (#12) pool. A review of some video will provide a better idea of what to expect.

49. JANSEN CREEK/LAKE

49.1. Stream Summary

Jansen Creek flows into Easy Inlet in the northern part of Kyuquot Sound. The creek drains Jansen Lake which is about 200 m upstream from the estuary. The lake and creek both have good clarity unless there is logging in the watershed.

49.2. Escapement Estimates

Survey Crew: KCFN (Keith Cox, Tyler Hanson), LGL (Shane Johnson)
Stock Assessment Biologist: D. McHugh

Table 49-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
23-Sep-16			12							
30-Oct-16			6							

49.3. Escapement Comments

SK return: No Sockeye Salmon were observed.

CO return: Fewer were observed in 2016 than in previous years. Based on the timing of the Oct survey, they should have encountered a significant portion of the return, however conditions were poor as the river was in flood.

PK return: No Pink Salmon were observed.

CM return: No Chum Salmon were observed.

CN return: No Chinook Salmon were observed.

49.4. Survey Protocols

49.5. Enhancement/Restoration Activities

A large log jam exists at the outlet of the lake and some debris were removed at some point. A Sockeye smolt study has occurred in years past. There is a fish ladder at the outlet of the lake to the Inlet.

49.6. Concerns and Comments

A feasibility study to remove woody debris at the Jensen Lake outlet should be completed and potential restoration (i.e., spawning gravel placement) measures be evaluated.

Log jam at the outlet is still there, fish were able to get past it into the lake in 2016.

50. KASHUTL RIVER

50.1. Stream Summary

Kashutl River flows south into head of Kashutl Inlet in northern Kyuquot Sound. The mainstem is 10.5 km and only the lower 2.2 km are surveyed. The upper survey reaches are characterized by deep canyon pools and steep riffles (Figure 50-2). The substrate consisted of boulders with some cobbles and gravel, and primarily holding/rearing habitats with some spawning habitats. The lower portion consists of shallow riffles with several avulsions, and some rearing and spawning habitats for salmonids. This is predominately a Chum and Coho salmon stream, with some Chinook salmon.

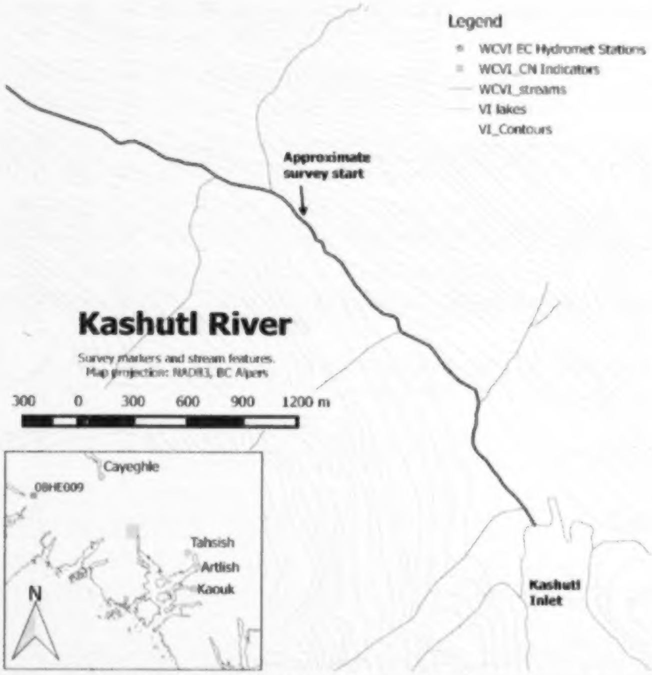

Legend
WCVI EC Hydromet Stations
WCVI_CN Indicators
WCVI_streams
VI lakes
VI_Contours
Approximate survey start
Kashutl River
Survey markers and stream features.
Map projection: NAD83, BC Albers
300 0 300 600 900 1200 m
Cayeghle
08HE009
Tahsish
Artlish
Kaouk
N
Kashutl Inlet

Figure 50-1. Location of the Kashutl River. Map inset shows the locations of other systems that are regularly surveyed in the area as well as the location of the Environment Canada hydromet station on the Klaskish River near Klaskino Inlet (08HE009). Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia.

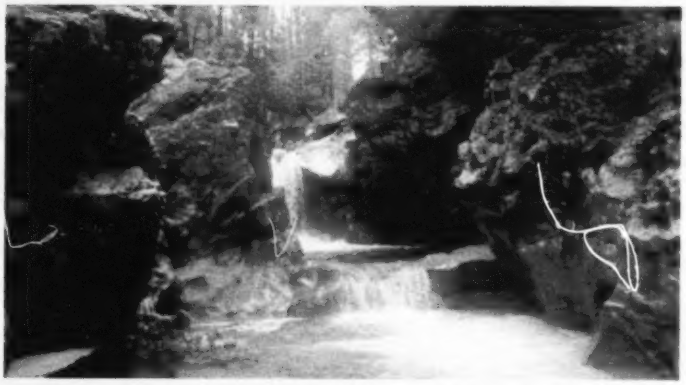


Figure 50-2. Looking upstream at anadromous falls in Kashutl River at 2.2km, no fish observed from here down past another set of falls ~50m downstream, which may by the anadromous barrier (Photo credit: Shane Johnson, November 19, 2014).

50.2. Escapement Estimates

Survey Crew: KCFN (Keith Cox, Tyler Hanson), LGL (Shane Johnson)
Stock Assessment Biologist: D. McHugh

Table 50-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**
28-Sep-16	1		97				136			

Comments: Only one of the four planned surveys occurred due to extended high water events through Oct and Nov.

50.3. Escapement Comments

All species less than the 12 year average, however coverage was poor due to high water levels mid-Oct to mid-Nov.

50.4. Survey Protocols

A 2.2 km snorkel survey is conducted by two surveyors, swimming downstream parallel to each other looking for adult salmon in the centre of the channel. It takes approximately three hours from the estuary to the start of the survey and back. Water temperature and horizontal visibility were measured during the survey. The crew traveled to the Kashutl River from Kyuquot Village by boat (40-50 minutes). Due to the high tide the crew was able to use the skiff to get to marker 1. The crew tied the skiff to shore, near the logging road bridge. The logging road was followed across the bridge before turning right (upstream) at the "T" in the road. Approximately 250 m from the turn off, the crew turned right onto an overgrown logging road (50°11'58.99"N; 127°18'59.26"W). This road was followed for ~550 m to the right bank of the Kashutl River. The crew then hiked upstream along the margins of the river to the anadromous barrier located ~200 m upstream of marker 4. The anadromous barrier is a ~6 m high falls.

50.5. Enhancement/Restoration Activities

50.6. Concerns and Comments

Intensive forestry activities has taken place of both sides of Kashutl River and could be the reason for increased water transport, resulting in bedload movement. In section 4-3, there is some bank erosion and an investigation into bank stabilization and riparian protection is recommended.

In section 3-2, several wind fallen trees on left bank have made the bank unstable.

51. KAUWINCH RIVER

51.1. Stream Summary

Kauwinch River flows south into the east side of Kashutl Inlet in Kyuquot Sound. The mainstem is almost 16 km long and the lower 6.5 is generally surveyed. The upper survey reaches are characterized by bedrock pool, riffles and glides, with all substrate types, but primarily of gravel and cobbles. There is a canyon in the upper survey area that should only be surveyed under low flow conditions. The lower portion consists of glides, pools, riffles and runs. There are several rearing and spawning habitats present. This is predominately a Chum and Coho Salmon stream with some Chinook Salmon.

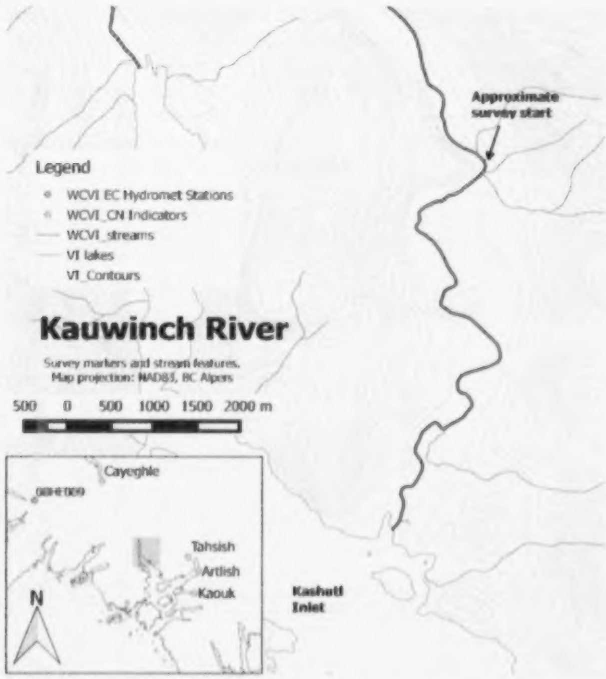

Approximate survey start
Legend
WCVI EC Hydromet Stations
WCVI_CN Indicators
WCVI_streams
VI lakes
VI_Contours
Kauwinch River
Survey markers and stream features.
Map projection: NAD83, BC Albers
500 0 500 1000 1500 2000 m
Cayeghle
08HE009
Tahsish
Artlish
Kaouk
N
Kashutl Inlet

Figure 51-1. Location of the Kashutl River. Map inset shows the locations of other systems that are regularly surveyed in the area as well as the location of the Environment Canada hydromet station on the Klaskish River near Klaskino Inlet (08HE009). Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia.

51.2. Escapement Estimates

Survey Crew: KCFN (Keith Cox, Tyler Hanson), LGL (Shane Johnson)
Stock Assessment Biologist: D. McHugh

Table 51-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
27-Sep-16	37		216		2		376		15	

Comments: Only one of the four planned surveys occurred due to extended high water events through Oct and Nov.

51.3. Escapement Comments

Sockeye above the 12 year average (~20)

All other species less than the 12 year average, but coverage was poor due to bad weather in Oct and Nov.

51.4. Environmental Conditions

A log jam spanning the channel, located in reach 1 was still present and does not impede fish passage

51.5. Survey Protocols

A 6.5 km snorkel survey is conducted by two surveyors, swimming downstream parallel to each other looking for adult salmon in the centre of the channel. It takes approximately five hours from the estuary to the start of the survey and back. Water temperature and horizontal visibility were measured during the survey. The crew traveled to Kauwinch River, from Kyuquot Village by boat (40-50 minutes). During high flows the canyons become unpassable.

51.6. Concerns and Comments

No difference in the river from 2015 to 2016. Three new fishermen trails are present in reaches 7-6, 2-1, and 1-0. They are well established and flagged.

52. COLONIAL CREEK/CAYEGHLE CREEK

52.1. Stream Summary

The Cayeghle Creek flows northwest into the head of Neroutsos Inlet in Quatsino Sound. The Cayeghle system is fed by the many small tributaries from the surrounding mountains. The largest tributary, Colonial Creek, enters the Cayeghle about 500 m upstream from the estuary. Both creeks are surveyed for salmon enumeration.

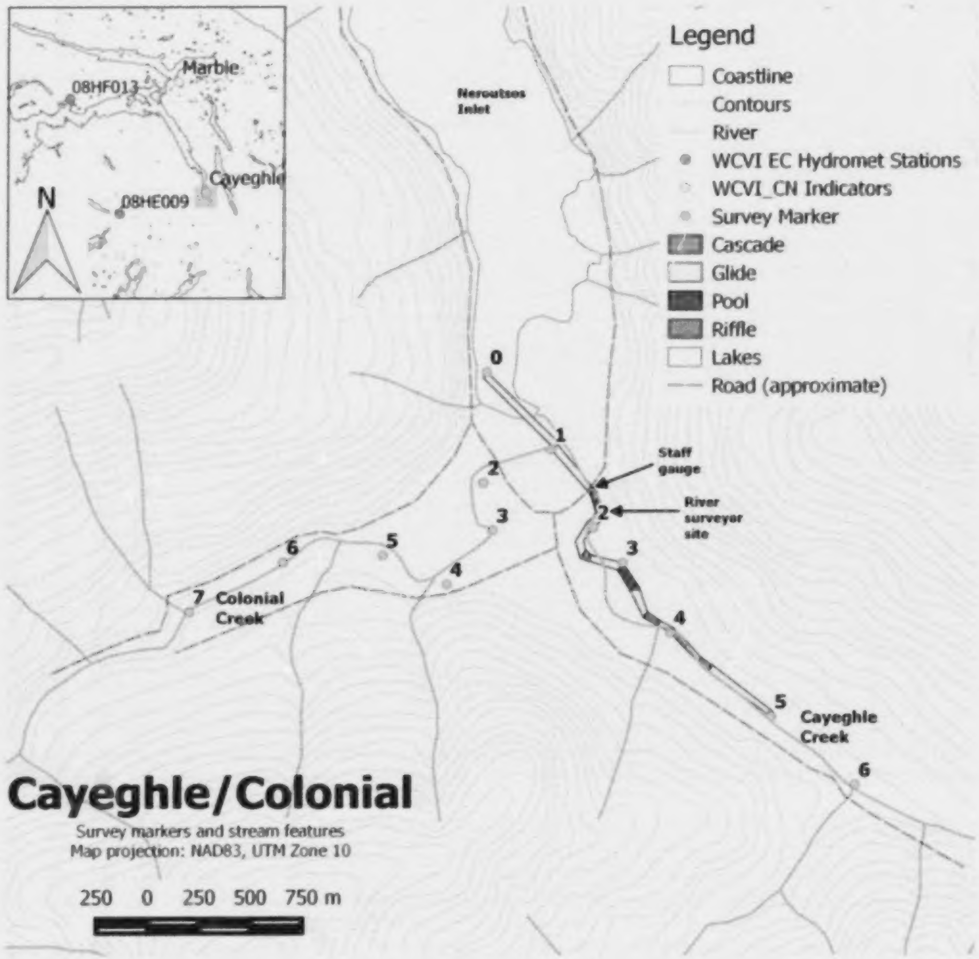

Marble
08HF013
Cayeghl
N
08HE009
Neroutsos Inlet
Legend
Coastline
Contours
River
WCVI EC Hydromet Stations
WCVI_CN Indicators
Survey Marker
Cascade
Glide
Pool
Riffle
Lakes
Road (approximate)
0
1
2
3
4
5
6
7
Staff gauge
River surveyor site
Colonial Creek
Cayeghle Creek
Cayeghle/Colonial
Survey markers and stream features
Map projection: NAD83, UTM Zone 10
250 0 250 500 750 m

Figure 52-1. Creek counting stations and habitat units. Map inset shows the location the Marble River, another regularly surveyed system in the area, as well as the location of the Environment Canada hydromet stations on the Klaskish River near Klaskino Inlet (08HE009) and Simpson Creek near Koprino Harbour (08HF013). Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. The logging road running the length of the system is not shown. Habitat data were mapped in the field and / or digitized from recent high resolution orthophotographs by M.C. Wright and Associates Ltd. Debris jam locations are approximate and as described in 2014.

The Cayeghle mainstem is over 8 km long and the lower 3 km is considered the most suitable spawning habitat, with 6 survey sections, each 500 m in length (Figure 52-1). The lower 3 km of Colonial Creek has also been divided into 6 survey sections for salmon enumeration. Another major tributary besides Colonial Creek is Utluh Creek which enters Cayeghle Creek at about marker 6.

Cayeghle Creek has a low gradient for most of the survey area. Above marker 6 the stream becomes narrower and slightly steeper at the lower end of a canyon. The canyon contains pools and chutes there have been observations of Coho and Chinook. The substrate in the system is mainly a mix of bedrock, gravel and cobble. There are large pools at markers 4 and 3 is used for holding. The left bank (looking downstream) between markers 3 and 2 has been heavily eroded in recent years.

The Colonial surveys start at marker 7 and end at marker 1 which is the confluence with Cayeghle Creek. The gradient on Colonial Creek is also low for most of the survey section and the substrate consists of mainly gravel, cobble and some bedrock. The Cayeghle system usually has excellent visibility except at high water.

Bears and other wildlife are common on the system. Seals have been observed up to survey marker 2 on Cayeghle. The watershed has been heavily logged and activities are ongoing. Logging roads cover a large part of the watershed and cross the stream and tributaries several times. Between markers 2 and 1 on Cayeghle Creek are the now inactive buildings from the Crystal Waters Atlantic Salmon Hatchery. There is a pulp mill in Port Alice that has been in operation since the 1950s.

52.2. Survey Results and Escapement Estimate

Survey Crew: NVISEA (D. McDougall, M. Ellens)
Stock Assessment Biologist: Diana McHugh

In 2016, the Colonial/Cayeghle system was snorkel surveyed 5 times between early September and mid-Oct. All surveys had excellent conditions with the exception of Sep 27 when above normal water levels compromised visibility. Generally good survey conditions but coverage may have missed the peak chum and coho.

Individual Survey Data:

Table 52-1. Unexpanded live and dead counts by species for each survey on ***Colonial Creek.***

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
07-Sep			55		1		43		96	
13-Sep			75		1		56		50	
27-Sep			151				183		48	
03-Oct			167		1		215	2	37	
11-Oct			218				546	6	25	
PL+D	0		218		1		552		96	
Exp PL+D	0		242		1		613		107	

Table 52-2.Unexpanded live and dead counts by species for each survey on ***Cayeghle Creek.***

Date	SK		CO		PK		CM		CN	
	Live	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**
07-Sep			145				57		90	
13-Sep	1		247				70		103	
27-Sep			230				412		122	
03-Oct	3		448				237		89	
11-Oct			517				868	13	118	2
PL+D	3		517				881		122	
Exp PL+D	3		574				979		188	

Table 52-3. Survey life and rationale for each species. Also includes the first and last zero used for the annual estimate if AUC was the estimate method used.

Species	Survey Life	First Zero	Last Zero	Comments
Sockeye				
Coho	35 (30-40)	Sep 1	Nov 15	
Pink				
Chum	15 (10-20)	Sep 1	Nov 15	
Chinook	25 (20-30)	Sep 1	Nov 15	

Table 52-4. Observer efficiency rationale. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:
For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%
For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

Date	OE category	Comments
07-Sep	Excellent	Water level below normal (0.16m), and clear. Horizontal vis 15.2m, vertical vis 7m
13-Sep	Excellent	Water level below normal (0.12m), and clear. Horizontal vis 12m, vertical vis 7m
27-Sep	Fair	Water level above normal (0.39m), and slightly turbid. Horizontal vis 6.3m, vertical vis 4.6m
03-Oc	Excellent	Water level below normal (0.14m), and clear. Horizontal vis 20.6m, vertical vis 9.5m
11-Oct	Excellent	Water level below normal (0.15m), and clear. Horizontal vis 16.9m, vertical vis 8.5m

Table 52-5. Escapement Estimates using the OE and SL parameters described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Species	Annual escapement estimate (Colonial)	Annual escapement estimate (Cayeghle)	Annual escapement estimate (Colonial/Cayeghle)	Analytical method	Data quality level
Sockeye	None Observed	3	3	PL+D	3
Coho	287 (251-334)	660 (577-769)	947	AUC	2
Pink	1	None Observed	1	PL+D	3
Chum	1194 (896-1791)	1929 (1444-2889)	3123	AUC	3, may have missed the peak
Chinook	113 (94-107)	285 (238-357)	398	AUC	2

Escapement Commentary:

SK return:	Above the 12 year average (~1)
CO return:	Similar to the 12 year average (~850)
PK return:	Less than the 12 year average (~10)
CM return:	Less than the 12 year average, but may have missed the peak.
CN return:	Similar to the 12 year average (~430)

52.3. Spawner Distribution

Run Timing:

Table 52-6. The run timing for the survey year by species.

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye							
Coho							
Pink							
Chum					Mid Sept	Early Oct	
Chinook						Mid Sept	

Spatial Distribution:

Table 52-7. The survey sections used by spawners per species.

Species	Survey Section(s) used for spawning	
	Cayeghle	Colonial
Sockeye		
Coho		
Pink		
Chum	5-0	6-1
Chinook	6-1	6-2
Steelhead		

Comments: Section marker 6 is in a canyon and is difficult for fish passage, although fish (notably Coho) have been noted upstream of this point.

52.4. Environmental Conditions

Weather Summary:

Physical Characteristics Update: River diverts through the bush and back below 3 marker missing 90% of segment 4-3 (basically from marker 4 directly to 2)

52.5. Update to Stream Survey Protocols

Current Assessment Method: The Cayeghle System is surveyed by a snorkel crew of two people every 7 to 10 days through the spawning season. On Cayeghle Creek, markers 6-1 are surveyed over a 3 km length. On Colonial Creek markers 6-1 are also surveyed over a 3 km length (they do count the confluence pool). Each system takes approximately 1.5 hours to survey. A staff gauge is located on the Cayeghle system, just upstream of the Marine Drive Main bridge. Discharge measurements are collected at the pool tail out just upstream of the bridge. There are orange flagging ribbons on either side of the river to identify the discharge measurement location.

Deviations from current assessment protocols:

Access Updates:

Safety Update: Trail needs work, currently bushwhacking through slash. Seems to be good habitat above marker 6.

52.6. Enhancement

These systems have had obvious habitat improvement structures built. Some are still in place; others are far from the current stream channel. The Cayeghle side had considerable rip rap dumped in at section marker 3 a few years ago to prevent further bank scouring and stabilization of the bank.

52.7. Biosamples

Two Chinook were biosampled. Both were age 3_1 (brood year 2013). One came from Conuma (a late seapen release) the other was unmarked.

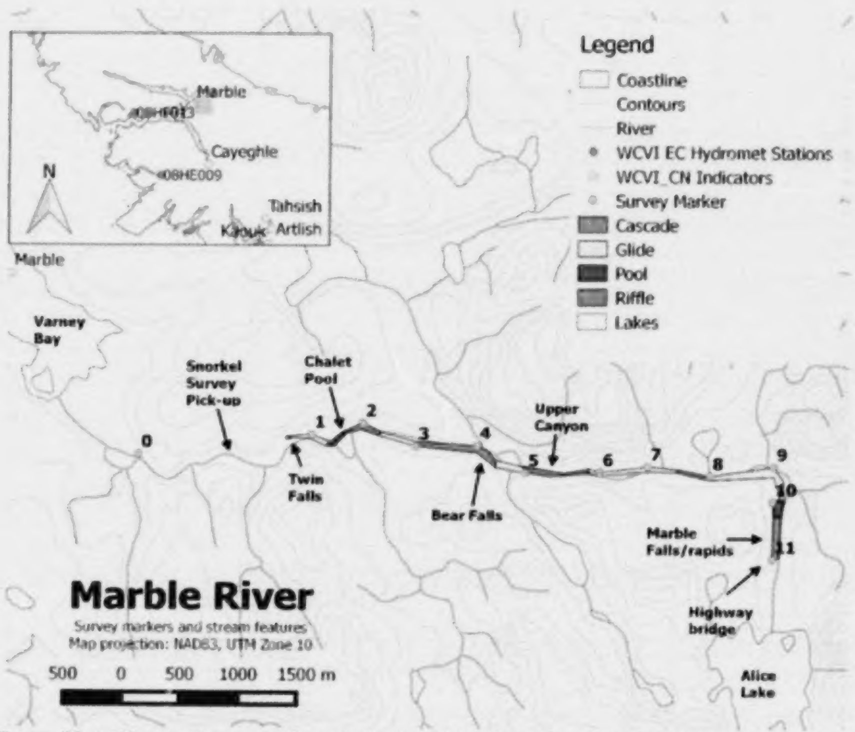
52.8. Concerns and Comments

- Seals are common and the surveyors identified many carcasses identified as “seals kills”
- Scouring, turbid water, flashy, high bed load movements
- Heavy logging activity
- Fishing activity and poaching are considered to be moderate or low
- It would be good to build new trails and clear out old trails
- Should consider adding a survey marker 8 to Colonial.

53. MARBLE RIVER

53.1. Stream Summary

The Marble River flows north through Victoria and Alice Lake, then west into Varney Bay, south of Rupert Inlet. The mainstem length is about 15 km long, but only 5 km in the lower system are surveyed for salmon enumeration. The majority of the Marble River is located within the Marble River Provincial Park. The Marble River Hatchery and Marble River Campsite located at Alice Lake outlet. Logging operations are active in the watershed.


Marble
08HF013
Cayeghle
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Tahsish
Kaouk
Artlish
Legend
Coastline
Contours
River
WCVI EC Hydromet Stations
WCVI_CN Indicators
Survey Marker
Cascade
Glide
Pool
Riffle
Lakes
Marble
Varney Bay
Snorkel Survey Pick-up
Chalet Pool
Upper Canyon
0
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3
4
5
6
7
8
9
10
11
Twin Falls
Bear Falls
Marble Falls/rapids
Highway bridge
Alice Lake
Marble River
Survey markers and stream features
Map projection: NAD83, UTM Zone 10
500 0 500 1000 1500 m

Figure 53-1. Marble River counting stations and habitat units. Map inset shows the location the Marble River, another regularly surveyed system in the area, as well as the location of the Environment Canada hydromet stations on the Klaskish River near Klaskino Inlet (08HE009) and Simpson Creek near Koprino Harbour (08HF013). Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. The logging road running the length of the system is not shown. Habitat data were mapped in the field and / or digitized from recent high resolution orthophotographs by M.C. Wright and Associates Ltd.

53.2. Survey Results and Escapement Estimate

Survey Crew: NVISEA (E. Wright)
Stock Assessment Biologist: Diana McHugh

The Marble River was surveyed 4 times between early September and early October. Heavy rains resulting in high flows in mid-October through mid-November prevented crews from entering the system. Reduced survey coverage and poor survey conditions result in less reliable escapement estimates for Marble River Chinook and Coho.

Survey Data:

Table 53-1. Unexpanded live (L) and dead (D) counts by species for each survey, peak live plus dead (PL+D) raw and expanded for OE. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:
For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%; For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

			SK		CO		PK		CM		CN	
Date	**OE cat.**	**Comments**	**Live**	**D**	**Live**	**D**	**Live**	**D**	**Live**	**D**	**Live**	**D**
31-Aug	Good	Water level below normal (.20m/.10m) Horizontal vis 9m, vertical vis 7m.			241	2					88	1
12-Sep	Good	Water level above normal (.41m/.31m) Horizontal vis 8m, vertical vis 12m.			344	5					1121	1
19-Sep	Good	Water level above normal (.43m/.37m) and slightly turbid. Horizontal vis 8m, vertical vis 7m.			273	7			3		530	2
04-Oct	Fair	Water level above normal (.45m/.34m), slightly turbid. Horizontal vis 7m, vertical vis 9m.			296	5					792	2
		Raw PL+D			349						1122	
		Exp PL+D			463						1402	

Note: first staff gauge reading recorded at segment 11-10, second recorded at the Chalet pool in segment 1-2.

Table 53-2. Survey life (SL), adult escapement estimate and rational how the method was applied. Escapement estimates use the OE described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Sp.	**SL**	**First Zero**	**Last Zero**	**Comments**	**Annual escapement estimate**	**Analytical method**	**Data quality level**
SK							
CO	35 (30-40)	27-Aug	15-Nov	Rain on Aug 28 likely brought in fish	664 (581-774)	AUC	3
PK							
CM							
CN	35 (30-40)	27-Aug	15-Nov	Rain on Aug 28 likely brought in fish	1606 (1405-1874)	AUC	2, but may have missed the peaks

Comments: It is highly likely (year dependant) that some Chinook and many Coho leave the survey area and move into Alice Lake. Radio tagging could not confirm Chinook migration past survey area. Chinook have been observed by snorkel crews in both Link and Benson Rivers. SL applied are consistent with historical values to allow between year comparisons.

Escapement Commentary:

SK return:

CO return: Less than the 12 year average (~2000)

PK return:

CM return:

CN return: *Less than the 12 year average (~3000), they took brood after the last survey*

53.3. Spawner Distribution

Run Timing:

Table 53-3. The run timing for the survey year by species.

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye							
Coho				July/August			
Pink							
Chum							
Chinook	July	August	Sept/Oct	Sept/Oct	Mid Sept		

Comments: Peak or end spawn not observed for either species. Chinook usually spawn in November, difficult to swim then historically.

Spatial Distribution:

Table 53-4. The survey sections used by spawners per species.

Species	Survey Section(s) used for spawning
Sockeye	
Coho	
Pink	
Chum	
Chinook	Usually spawn Bear Falls (section 4) down to section 1, and by the campground pool (10-8)
Steelhead	

53.4. Environmental Conditions

Weather Summary: Water levels are usually low and relatively clear throughout most of September.

Physical Characteristics Update:

53.5. Update to Stream Survey Protocols

Current Assessment Method:

Snorkel surveys are planned for every 7 to 10 days beginning in early September, as flows allow. Survey begins at marker 11 (below rapids at the highway bridge) and ends at marker 1 (just above Twin Falls). Historically surveyors continued swimming downstream past twin falls and through the lower canyon where they would be picked up by boat (tide dependant). In 2012, a trail was blazed out allowing surveyors to hike out from the lower Marble and get picked up via truck off the Varney 510 logging road.

Environmental measurements are collected in various spots on the Marble. Horizontal measurements are usually conducted at the starting point at marker 11, and again at the Chalet Pool in section 2-1. There are 3 staff gauges set up on the Marble. One is on the highway bridge piling which can be observed from river right bank. A second staff gauge is anchored to the rocks at the "get in" point at marker 11. The third staff gauge is in the Chalet pool in section 2-1 on river right bank just behind the inside corner of the pool.

There is a mid-river canyon section that does not get surveyed. Survey crews swim downstream to the anglers access pool (marker 6), then get out on river left bank and hike up to the Marble trail that follows the river. The canyon bi-pass is about 800 meters down the trail before the swim crew cuts down the river bank back down to the river below the canyon (just above marker 5). Bear Falls are at the bottom of section 5-4. Surveyors need to get out above the falls and hike around and drop back in below the falls. Going through the fish way or over the falls would be catastrophic.

The survey takes about 5 hours to complete, plus the hike out from Chalet Pool which is an additional half hour.

Deviations from current assessment protocols:

Access Updates:

Access to the "get in" point at marker 11 is still the same (little trail from camp ground road down along the cement release race way).

The lower river trail is difficult to find, but it exits the river from the clay bank just below the "mini chalet" pool on river right. There is flagging tape there to mark the trail head. Vehicle access is via the Varney main logging road, then left on the V500, and a quick right on the V510. This takes you up to a new cut block where the truck parks and waits for the swim crew to emerge from trail.

Safety Update:

No safety updates, just be aware of mid river canyon (marker 6-5), Bear Falls (marker 5-4) and possibly Twin Falls which is below the survey area (marker 1-0). A "no swim" cut off point is established at 0.6 m on the hatchery staff gauge in the intake well.

53.6. Enhancement

Brood Removal: 289 Chinook biosampled in broodstock collection operations via beach seine in the Chalet pool. Eggs were taken from 154 females and milt was taken from 60 males, 74 died before their eggs or milt could be harvested (6 females, 68 males). They did not take any coho brood.

53.7. Biosamples

Escapement biosamples taken from morts in the river: Two Chinook, both sampled Sept 19, were both age 4_1 (brood year 2012).

Brood biosamples: Of the 282 submitted otoliths that were readable, 212 were unmarked, 68 were from the Marble River Hatchery, 1 was from Conuma Hatchery, and 1 was from Robertson Creek Hatchery.

53.8. Concerns and Comments

WCVI IN-SEASON ESCAPEMENT BULLETINS

WCVI ESCAPEMENT BULLETIN – SEPTEMBER 9, 2016

Fisheries and Oceans Canada
Pêches et Océans Canada

WCVI Salmon Escapement Bulletin
Chinook, Coho and Chum
Extensive Indicator Program
In-season Update, September 9, 2016

IN-SEASON OBSERVATIONS:

River levels were fairly low through most of the summer, but a rain event in late-August, over 140mm of rain from Aug 27 to Sept 4, caused high water levels in many index systems, bringing Chinook and Coho into many systems and briefly delaying the first swims in some index systems.[1].

Peak escapement of chinook to WCVI rivers is typically about the first week of October.

Peak escapement of chum to WCVI rivers is typically mid to late October.

Peak escapement of coho to WCVI rivers is typically late October to early November.

Peak escapement of sockeye to Clemens Creek is typically mid to late October.

Port Renfrew (Area 20): The San Juan fence is being installed this weekend. Swim surveys of the San Juan and major tributaries will be conducted following fence removal to produce a Coho peak count.

Nitinat (Area 22): Four swims are planned in Nitinat starting in mid-September. Hatchery staff have observed thousands of fish in the river, and a swim survey is planned for early next week.

Barkley Sound/Alberni Inlet (Area 23): Initial surveys have been completed on schedule in Area 23.Chinook are at 17% of the 12 year average as of last week in Nahmint, and are at least 83% the 12 year average in Sarita. It is too early to determine the magnitude of the Clemens sockeye return based on the current surveys, but the Henderson River fence operated by Uchucklesaht and the NTC has estimated roughly 9400 Sockeye passing into Henderson Lake. The lake temperature at one meter depth has dropped from 22 degrees Aug 29, to 20 degrees Sept 7.

Clayoquot Sound (Area 24): Some initial surveys have been delayed due to fog. The first swim survey in Tranquil saw more Chinook than is typical given the date, indicating possibly early timing. Large mixed groups of fish have been seen moving through the Lower Kennedy, and a DIDSON should be installed next week.

Nootka Sound/Esperanza Inlet (Area 25): Surveys of Tahsis, Leiner, Burman and Conuma have occurred generally as scheduled. Chinook are above the 12 year average in both Leiner and Canton.

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[1] Precipitation totals from the Environment Canada Monitoring Station in Tofino

Kyuquot Sound (Area 26): Initial surveys of Kaouk and Artlish have occurred as scheduled. The first Tahsish survey was delayed due to weather.

Quatsino Sound (Area 27): Initial surveys of Marble and Cayeghle have occurred as scheduled.

ESCAPEMENT MONITORING FRAMEWORK:

For WCVI salmon and most other BC management units, a system of 'intensive' and 'extensive' indicator stocks are used to assess stock status and fishery impacts and provide recommendations for harvest management.

Intensive indicator stocks describe the distribution, exploitation and survival rate patterns for populations within a management unit that have a similar life history and marine distribution. This information is collected through the coast-wide Mark-Recovery Program (MRP). Select stocks are tagged with coded-wire-tags as juveniles and through recoveries of these tags in fisheries and escapement survival and exploitation rates are estimated.

Robertson Creek Hatchery located in DFO Statistical Area 23 (Barkley Sound/Alberni Inlet) is the CWT hatchery indicator stock for WCVI chinook and coho populations. Carnation Creek, also located in Area 23, is the CWT wild indicator stock for WCVI coho. There is no CWT indicator program from chum salmon.

Extensive indicator stocks provide information about the variability of status of populations across the management unit. The specific goals of the program are utilize consistent escapement survey methodologies; estimate total escapement by river using analytical techniques such as the area-under-the-curve (AUC) method for observation expansion; to establish a time series of escapement information and habitat capacity for use in establishing escapement goals; and to estimate hatchery contribution to rivers.

The following populations are used as extensive indicator stocks for WCVI salmon:

Chinook: Nitinat, Nahmint, Sarita, Bedwell/Ursus, Megin, Tranquil, Burman, Conuma, Leiner, Tahsis, Artlish, Kaouk, Tahsish, Colonial/Cayeghle, Marble

Coho: Malksope

Chum: Most of the Chinook indicators with the addition of Little Zeballos, Zeballos, and Park.

Other Escapement Information: Escapement information for non-indicator stocks may be provided through other programs. Depending on the frequency of surveys and types of methods employed, the resulting information may be of limited utility to inform management decisions. However, the observations provide a useful gauge of spawner distribution in rivers across the WCVI area and this information is used to monitor biodiversity.

Data Quality: The WCVI escapement monitoring program results in escapement estimates of variable quality. While all the information is useful, not all estimates should be accorded the

same weight in fisheries management decisions.[2] The following guidelines were used to rank the escapement information presented in this bulletin:

Level 1 (High Quality) Estimates. Level 1 escapement estimates are subject to quality control and peer review. Estimates of abundance are reliable and include an estimate of uncertainty. For most years in the WCVI area, Level 1 estimates are limited to those generated through he "intensive" indicator stocks programs.

Level 2 (Medium or Mixed Quality) Estimates. These estimates have some inherent shortcomings with regard to scientific quality (e.g. greater uncertainly, potential biases, etc.); however they are still useful for informing fishery management decisions. For WCVI spawning populations, Level 2 escapement estimates have typically been generated through periodic visual counts of spawners using the snorkel survey method and expanding for observer error and survey life with the area-under-the-curve procedure.

Level 3 (Low Quality) Estimates. These estimates substantially fail to meet standards of scientific quality and therefore are of limited utility for informing fishery management decisions. However, the information is still used to monitor biodiversity within the WCVI management area. Level 3 escapement information may include observations gathered from partial or infrequent surveys or using methods subject to higher observation error (e.g. bank walks).

This bulletin updates in-season assessment results of Level 1 to 3 escapement surveys for WCVI chinook, coho and chum populations. Note: during the survey escapement information may also be collected for other species.

IN-SEASON RESULTS:

Table 1 displays the raw peak spawner counts to date of WCVI salmon survey populations.

Table 2 displays the 5 and 12 year average estimated escapement for WCVI extensive indicator systems.

For more information Contact:
Diana McHugh,
WCVI Salmon Extensive Assessment Program Biologist
Telephone (250) 756-7006, Fax (250) 756-7162
E-mail: Diana.McHugh@dfo-mpo.gc.ca

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[2] The ranking scheme here weighs heavily on the Research and Science Information Standard for New Zealand Fisheries (NZ Ministry of Fisheries, 2011). When ranking the quality of scientific information, information is evaluated according to how well it meets the following scientific principles: methodology has been subject to peer review, data are relevant to management decision, integrity, objectivity, and reliability (i.e. repeatability) of estimate.

Table 1. Raw Peak Live plus Dead counts to date for 2016 WCVI salmon survey populations.

Fisheries and Oceans Canada | Pêches et Océans Canada

Total no. surveys: 14

Stock Assessment Division, South Coast Salmon
For more information contact: Diana McHugh
(250) 756-7006

2016 Preliminary Escapement Obervations

Summary Note:
Raw Peak Live Plus Dead Counts (I.e. maximum number of fish counted for any one survey). Sproat numbers current as of Sept 4, Stamp numbers as of Sept 4, Carnation as of Sept 9.

Level 1 Streams

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
23	CARNATION CREEK	Fence	-	-	-	-	-	-	CO
23	SPROAT RIVER	Fence	1	1,778	218,697	NA	NA	NA	CN/SK
23	STAMP RIVER	Fence	3,549	7,028	218,877	4	489	3	CN/SK

Level 2 WCVI Indicator Streams **2016 Peak Live + Dead Count to Date**

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
22	NITINAT RIVER	0	-	-	-	-	-	-	CN
23	CLEMENS CREEK	2	-	97	249	-	2	-	SK
23	NAHMINT RIVER	1	55	-	75	-	1	-	CN
23	SARITA RIVER	1	1,186	15	6	2	-	-	CN
24	BEDWELL RIVER	0	-	-	-	-	-	-	CN
24	MEGIN RIVER	0	-	-	-	-	-	-	CN
24	TRANQUIL CREEK	0	24	-	-	-	-	-	CN
25	BURMAN RIVER	1	1,160	-	10	-	-	-	CN
25	CONUMA RIVER	1	17,189	47	51	25	-	-	CN
25	LEINER RIVER	1	1,300	409	924	132	-	1	CN
25	LITTLE ZEBALLOS RIVER	0	-	-	-	-	-	-	CM
25	PARK RIVER	0	-	-	-	-	-	-	CM
25	TAHSIS RIVER	1	84	250	436	5	-	3	CN
25	ZEBALLOS RIVER	0	-	-	-	-	-	-	CM
26	ARTLISH RIVER	1	114	71	8	9	3	-	CN
26	KAOUK RIVER	1	213	344	41	14	7	1	CN
26	TAHSISH RIVER	1	331	192	8	11	3	3	CN
26	MALKSOPE RIVER	0	-	-	-	-	-	-	CO
27	CAYEGHLE SYSTEM	1	186	200	-	97	3	1	CN
27	MARBLE RIVER	1	89	243	-	-	24	-	CN

Level 3 Streams **2016 Peak Live + Dead Count to Date**

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
25	CANTON CREEK	1	4,124	127	2	20	-	-	

Table 2. Average escapement (last 5 and 12 years) for Level 2 WCVI Indicator Systems; for Chum Indicator Systems, only chum averages are presented as chum-directed surveys cover chinook and coho distributions and timing poorly.

		Average Escapement Estimates					
Area	**System**	**CN Adults**		**CO Adults**		**CM Adults**	
		5yr avg	**12yr avg**	**5yr avg**	**12yr avg**	**5yr avg**	**12yr avg**
20	SAN JUAN RIVER	1,600	1,900	7,300	5,600	1,200	900
22	NITINAT RIVER	10,900	10,300	4,700	4,700	158,000	144,000
23	CLEMENS CREEK	200	100	2,200	2,100	120	130
23	NAHMINT RIVER	300	300	500	400	12,300	14,900
23	SARITA RIVER	1,400	1,400	900	700	11,600	9,900
24	BEDWELL RIVER	380	200	1,300	1,200	3,300	3,300
24	MEGIN RIVER	60	50	1,600	1,100	1,900	1,900
24	TRANQUIL CREEK	320	390	1,000	800	9,000	9,400
25	BURMAN RIVER	4,000	2,400	1,300	1,300	5,200	4,800
25	CONUMA RIVER	28,000	21,700	2,200	2,500	7,900	9,000
25	LEINER RIVER	480	420	1,040	850	2,500	4,200
25	LITTLE ZEBALLOS RIVER	NA	NA	NA	NA	4,500	3,900
25	PARK RIVER	NA	NA	NA	NA	3,300	4,500
25	TAHSIS RIVER	270	330	1,300	1,400	5,400	6,400
25	TSOWWIN RIVER	NA	NA	NA	NA	1,600	4,700
25	ZEBALLOS RIVER	NA	NA	NA	NA	5,400	5,800
26	ARTLISH RIVER	370	280	1,900	1,400	5,700	4,700
26	KAOUK RIVER	260	320	2,600	2,300	9,900	8,800
26	MALKSOPE	NA	NA	2,300	2,300	10,400	10,400
26	TAHSISH RIVER	430	330	3,400	2,700	6,500	5,500
27	CAYEGHLE SYSTEM	310	430	800	840	12,600	10,700
27	MARBLE RIVER	3,200	3,100	1,400	2,000	NA	NA

WCVI ESCAPEMENT BULLETIN – SEPTEMBER 16, 2016

Fisheries and Oceans Canada
Pêches et Océans Canada

WCVI Salmon Escapement Bulletin
Chinook, Coho and Chum
Extensive Indicator Program
In-season Update, September 16, 2016

IN-SEASON OBSERVATIONS:

River levels were fairly low through most of the summer, but a rain event in late-August, over 140mm of rain from Aug 27 to Sept 4, caused high water levels in many index systems, bringing Chinook and Coho into many systems and briefly delaying the first swims in some index systems.[3]

Peak escapement of chinook to WCVI rivers is typically about the first week of October.

Peak escapement of chum to WCVI rivers is typically mid to late October.

Peak escapement of coho to WCVI rivers is typically late October to early November.

Peak escapement of sockeye to Clemens Creek is typically mid to late October.

Port Renfrew (Area 20): The San Juan fence has been installed. Swim surveys of the San Juan and major tributaries will be conducted following fence removal to produce a Coho peak count.

Nitinat (Area 22): Four swims are planned in Nitinat starting in mid-September. Hatchery staff observed thousands of fish in the river, and a swim survey this week counted roughly 6,000 adult Chinook and 1,200 jack Chinook.

Barkley Sound/Alberni Inlet (Area 23): Initial surveys have been completed on schedule in Area 23. Chinook are at least 50% of the 12 year average as of today in Nahmint, and are at least 83% the 12 year average in Sarita. It is too early to determine the magnitude of the Clemens sockeye return based on the current surveys, but the Henderson River fence operated by Uchucklesaht and the NTC has estimated roughly 9400 Sockeye passing into Henderson Lake. The lake temperature at one meter depth has dropped from 22 degrees Aug 29, to 20 degrees Sept 7, but has increased to 21 degrees as of Sept 12.

Clayoquot Sound (Area 24): The initial surveys for Moyeha, Tranquil, Bedwell, Cypre and Megin have been completed.

Nootka Sound/Esperanza Inlet (Area 25): Surveys of Tahsis, Leiner, Burman and Conuma have occurred generally as scheduled. Chinook are above the 12 year average in both Leiner and Canton. Sockeye numbers are also above the 12 year average in both the Tahsis and the Leiner.

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[3] Precipitation totals from the Environment Canada Monitoring Station in Tofino

Kyuquot Sound (Area 26): Initial surveys of Kaouk, Artlish, and Tahsish have occurred. Chinook are already slightly above the 12 year average in Tahsish.

Quatsino Sound (Area 27): Initial surveys of Marble and Cayeghle have occurred as scheduled.

ESCAPEMENT MONITORING FRAMEWORK:

For WCVI salmon and most other BC management units, a system of 'intensive' and 'extensive' indicator stocks are used to assess stock status and fishery impacts and provide recommendations for harvest management.

Intensive indicator stocks describe the distribution, exploitation and survival rate patterns for populations within a management unit that have a similar life history and marine distribution. This information is collected through the coast-wide Mark-Recovery Program (MRP). Select stocks are tagged with coded-wire-tags as juveniles and through recoveries of these tags in fisheries and escapement survival and exploitation rates are estimated.

Robertson Creek Hatchery located in DFO Statistical Area 23 (Barkley Sound/Alberni Inlet) is the CWT hatchery indicator stock for WCVI chinook and coho populations. Carnation Creek, also located in Area 23, is the CWT wild indicator stock for WCVI coho. There is no CWT indicator program from chum salmon.

Extensive indicator stocks provide information about the variability of status of populations across the management unit. The specific goals of the program are utilize consistent escapement survey methodologies; estimate total escapement by river using analytical techniques such as the area-under-the-curve (AUC) method for observation expansion; to establish a time series of escapement information and habitat capacity for use in establishing escapement goals; and to estimate hatchery contribution to rivers.

The following populations are used as extensive indicator stocks for WCVI salmon:

Chinook: Nitinat, Nahmint, Sarita, Bedwell/Ursus, Megin, Tranquil, Burman, Conuma, Leiner, Tahsis, Artlish, Kaouk, Tahsish, Colonial/Cayeghle, Marble

Coho: Malksope

Chum: Most of the Chinook indicators with the addition of Little Zeballos, Zeballos, and Park.

Other Escapement Information: Escapement information for non-indicator stocks may be provided through other programs. Depending on the frequency of surveys and types of methods employed, the resulting information may be of limited utility to inform management decisions. However, the observations provide a useful gauge of spawner distribution in rivers across the WCVI area and this information is used to monitor biodiversity.

Data Quality: The WCVI escapement monitoring program results in escapement estimates of variable quality. While all the information is useful, not all estimates should be accorded the

same weight in fisheries management decisions.[4] The following guidelines were used to rank the escapement information presented in this bulletin:

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This bulletin updates in-season assessment results of Level 1 to 3 escapement surveys for WCVI chinook, coho and chum populations. Note: during the survey escapement information may also be collected for other species.

IN-SEASON RESULTS:

Table 1 displays the raw peak spawner counts to date of WCVI salmon survey populations.

Table 2 displays the 5 and 12 year average estimated escapement for WCVI extensive indicator systems.

For more information Contact:
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Telephone (250) 756-7006, Fax (250) 756-7162
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[4] The ranking scheme here weighs heavily on the Research and Science Information Standard for New Zealand Fisheries (NZ Ministry of Fisheries, 2011). When ranking the quality of scientific information, information is evaluated according to how well it meets the following scientific principles: methodology has been subject to peer review, data are relevant to management decision, integrity, objectivity, and reliability (i.e. repeatability) of estimate.

Table 1. Raw Peak Live plus Dead counts to date for 2016 WCVI salmon survey populations.

Fisheries and Oceans Canada Pêches et Océans Canada

Stock Assessment Division, South Coast Salmon
For more information contact: Diana McHugh
(250) 756-7006

Total no. surveys: 33

2016 Preliminary Escapement Obervations

Summary Note:
Raw Peak Live Plus Dead Counts (I.e. maximum number of fish counted for any one survey). Sproat numbers current as of Sept 14, Stamp numbers as of Sept 14, Carnation as of Sept 16.

Level 1 Streams

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
23	CARNATION CREEK	Fence	-	-	-	-	-	-	CO
23	SPROAT RIVER	Fence	1	2,337	218,958	11	23	NA	CN/SK
23	STAMP RIVER	Fence	6,109	15,224	219,808	4	549	3	CN/SK

Level 2 WCVI Indicator Streams **2016 Peak Live + Dead Count to Date**

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
22	NITINAT RIVER	1	6,002	10	387	4	14	-	CN
23	CLEMENS CREEK	3	-	174	313	-	2	-	SK
23	NAHMINT RIVER	3	173	43	622	7	1	-	CN
23	SARITA RIVER	2	1,186	49	15	2	1	-	CN
24	BEDWELL RIVER	1	53	342	222	8	-	1	CN
24	MEGIN RIVER	1	14	215	1	26	-	-	CN
24	TRANQUIL CREEK	1	23	25	209	40	3	1	CN
25	BURMAN RIVER	1	1,160	-	10	-	-	-	CN
25	CONUMA RIVER	1	17,189	47	51	25	-	-	CN
25	LEINER RIVER	1	1,300	409	924	132	-	1	CN
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25	PARK RIVER	0	-	-	-	-	-	-	CM
25	TAHSIS RIVER	1	84	250	436	5	-	3	CN
25	ZEBALLOS RIVER	1	1	-	-	-	-	-	CM
26	ARTLISH RIVER	2	114	128	9	20	3	1	CN
26	KAOUK RIVER	2	215	612	41	27	7	1	CN
26	TAHSISH RIVER	1	331	192	8	11	3	3	CN
26	MALKSOPE RIVER	0	-	-	-	-	-	-	CO
27	CAYEGHLE SYSTEM	2	186	322	1	126	3	1	CN
27	MARBLE RIVER	2	1,122	349	-	-	24	-	CN

Level 3 Streams **2016 Peak Live + Dead Count to Date**

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
23	TOQUAHT RIVER	1	150	266	14	111	7	-	CN
24	CYPRE RIVER	1	220	96	13	4	-	-	CN
24	MOYEHA RIVER	1	50	157	222	18	3	1	CN
25	CANTON CREEK	1	4,124	127	2	20	-	-	CN
25	ESPINOSA CREEK	1	-	-	-	-	-	-	CM
25	KLEEPTEE CREEK	1	2	1	-	350	-	-	CM
25	MOOYAH RIVER	1	-	-	-	-	-	-	CM

Table 2. Average escapement (last 5 and 12 years) for Level 2 WCVI Indicator Systems; for Chum Indicator Systems, only chum averages are presented as chum-directed surveys cover chinook and coho distributions and timing poorly.

		Average Escapement Estimates					
Area	**System**	**CN Adults**		**CO Adults**		**CM Adults**	
		5yr avg	**12yr avg**	**5yr avg**	**12yr avg**	**5yr avg**	**12yr avg**
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22	NITINAT RIVER	10,900	10,300	4,700	4,700	158,000	144,000
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WCVI ESCAPEMENT BULLETIN – SEPTEMBER 23, 2016

Fisheries and Oceans Canada Pêches et Océans Canada

WCVI Salmon Escapement Bulletin
Chinook, Coho and Chum
Extensive Indicator Program
In-season Update, September 23, 2016

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River levels were fairly low through most of the summer, but a rain event in late-August, over 140mm of rain from Aug 27 to Sept 4, caused high water levels in many index systems, bringing Chinook and Coho into many systems and briefly delaying the first swims in some index systems.[5]

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same weight in fisheries management decisions.[6] The following guidelines were used to rank the escapement information presented in this bulletin:

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Level 2 (Medium or Mixed Quality) Estimates. These estimates have some inherent shortcomings with regard to scientific quality (e.g. greater uncertainly, potential biases, etc.); however they are still useful for informing fishery management decisions. For WCVI spawning populations, Level 2 escapement estimates have typically been generated through periodic visual counts of spawners using the snorkel survey method and expanding for observer error and survey life with the area-under-the-curve procedure.

Level 3 (Low Quality) Estimates. These estimates substantially fail to meet standards of scientific quality and therefore are of limited utility for informing fishery management decisions. However, the information is still used to monitor biodiversity within the WCVI management area. Level 3 escapement information may include observations gathered from partial or infrequent surveys or using methods subject to higher observation error (e.g. bank walks).

This bulletin updates in-season assessment results of Level 1 to 3 escapement surveys for WCVI chinook, coho and chum populations. Note: during the survey escapement information may also be collected for other species.

IN-SEASON RESULTS:

Table 1 displays the raw peak spawner counts to date of WCVI salmon survey populations.

Table 2 displays the 5 and 12 year average estimated escapement for WCVI extensive indicator systems.

For more information Contact:
Diana McHugh,
WCVI Salmon Extensive Assessment Program Biologist
Telephone (250) 756-7006, Fax (250) 756-7162
E-mail: Diana.McHugh@dfo-mpo.gc.ca

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[6] The ranking scheme here weighs heavily on the Research and Science Information Standard for New Zealand Fisheries (NZ Ministry of Fisheries, 2011). When ranking the quality of scientific information, information is evaluated according to how well it meets the following scientific principles: methodology has been subject to peer review, data are relevant to management decision, integrity, objectivity, and reliability (i.e. repeatability) of estimate.

Table 1. Raw Peak Live plus Dead counts to date for 2016 WCVI salmon survey populations.

Fisheries and Oceans Canada Pêches et Océans Canada

Stock Assessment Division, South Coast Salmon
For more information contact: Diana McHugh
(250) 756-7006

Total no. surveys: 42

2016 Preliminary Escapement Obervations

Summary Note:
Raw Peak Live Plus Dead Counts (I.e. maximum number of fish counted for any one survey). Sproat numbers current as of Sept 17, Stamp numbers as of Sept 17, Carnation as of Sept 22.

Level 1 Streams

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
23	CARNATION CREEK	Fence	-	-	-	-	-	-	CO
23	SPROAT RIVER	Fence	1	2,703	218,995	11	23	-	CN/SK
23	STAMP RIVER	Fence	8,120	16,035	219,904	4	571	3	CN/SK

Level 2 WCVI Indicator Streams **2016 Peak Live + Dead Count to Date**

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
22	NITINAT RIVER	1	6,002	10	387	4	14	-	CN
23	CLEMENS CREEK	4	13	697	723	4	2	-	SK
23	NAHMINT RIVER	4	243	226	622	161	8	-	CN
23	SARITA RIVER	3	1,268	373	15	43	1	-	CN
24	BEDWELL RIVER	1	53	342	222	8	-	1	CN
24	MEGIN RIVER	1	14	215	1	26	-	-	CN
24	TRANQUIL CREEK	1	23	25	209	40	3	1	CN
25	BURMAN RIVER	3	3,227	449	566	1,027	-	-	CN
25	CONUMA RIVER	2	17,189	624	51	119	-	-	CN
25	LEINER RIVER	2	1,300	409	1,050	157	-	1	CN
25	LITTLE ZEBALLOS RIVER	0	-	-	-	-	-	-	CM
25	PARK RIVER	0	-	-	-	-	-	-	CM
25	TAHSIS RIVER	2	84	250	436	13	-	3	CN
25	ZEBALLOS RIVER	1	1	-	-	-	-	-	CM
26	ARTLISH RIVER	2	114	128	9	20	3	1	CN
26	KAOUK RIVER	2	215	612	41	27	7	1	CN
26	TAHSISH RIVER	1	331	192	8	11	3	3	CN
26	MALKSOPE RIVER	0	-	-	-	-	-	-	CO
27	CAYEGHLE SYSTEM	2	186	322	1	126	3	1	CN
27	MARBLE RIVER	3	1,122	349	-	3	24	-	CN

Level 3 Streams **2016 Peak Live + Dead Count to Date**

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
23	TOQUAHT RIVER	1	150	266	14	111	7	-	CN
24	CYPRE RIVER	1	220	96	13	4	-	-	CN
24	MOYEHA RIVER	1	50	157	222	18	3	1	CN
25	CANTON CREEK	1	4,124	127	2	20	-	-	CN
25	ESPINOSA CREEK	1	-	-	-	-	-	-	CM
25	KLEEPTEE CREEK	1	2	1	-	350	-	-	CM
25	MOOYAH RIVER	1	-	-	-	-	-	-	CM

Table 2. Average escapement (last 5 and 12 years) for Level 2 WCVI Indicator Systems; for Chum Indicator Systems, only chum averages are presented as chum-directed surveys cover chinook and coho distributions and timing poorly.

		Average Escapement Estimates					
Area	**System**	**CN Adults**		**CO Adults**		**CM Adults**	
		5yr avg	**12yr avg**	**5yr avg**	**12yr avg**	**5yr avg**	**12yr avg**
20	SAN JUAN RIVER	1,600	1,900	7,300	5,600	1,200	900
22	NITINAT RIVER	10,900	10,300	4,700	4,700	158,000	144,000
23	CLEMENS CREEK	200	100	2,200	2,100	120	130
23	NAHMINT RIVER	300	300	500	400	12,300	14,900
23	SARITA RIVER	1,400	1,400	900	700	11,600	9,900
24	BEDWELL RIVER	380	200	1,300	1,200	3,300	3,300
24	MEGIN RIVER	60	50	1,600	1,100	1,900	1,900
24	TRANQUIL CREEK	320	390	1,000	800	9,000	9,400
25	BURMAN RIVER	4,000	2,400	1,300	1,300	5,200	4,800
25	CONUMA RIVER	28,000	21,700	2,200	2,500	7,900	9,000
25	LEINER RIVER	480	420	1,040	850	2,500	4,200
25	LITTLE ZEBALLOS RIVER	NA	NA	NA	NA	4,500	3,900
25	PARK RIVER	NA	NA	NA	NA	3,300	4,500
25	TAHSIS RIVER	270	330	1,300	1,400	5,400	6,400
25	TSOWWIN RIVER	NA	NA	NA	NA	1,600	4,700
25	ZEBALLOS RIVER	NA	NA	NA	NA	5,400	5,800
26	ARTLISH RIVER	370	280	1,900	1,400	5,700	4,700
26	KAOUK RIVER	260	320	2,600	2,300	9,900	8,800
26	MALKSOPE	NA	NA	2,300	2,300	10,400	10,400
26	TAHSISH RIVER	430	330	3,400	2,700	6,500	5,500
27	CAYEGHLE SYSTEM	310	430	800	840	12,600	10,700
27	MARBLE RIVER	3,200	3,100	1,400	2,000	NA	NA

Fisheries and Oceans Canada
Pêches et Océans Canada

WCVI Salmon Escapement Bulletin
Chinook, Coho and Chum
Extensive Indicator Program
In-season Update, September 30, 2016

IN-SEASON OBSERVATIONS:

River levels were fairly low through most of the summer, but a rain event in late-August, over 140mm of rain from Aug 27 to Sept 4, caused high water levels in many index systems, bringing Chinook and Coho into many systems and briefly delaying the first swims in some index systems.[7] Chinook spawning has begun in most systems.

Peak escapement of Chinook to WCVI rivers is typically about the first week of October.

Peak escapement of Chum to WCVI rivers is typically mid to late October.

Peak escapement of Coho to WCVI rivers is typically late October to early November.

Peak escapement of Sockeye to Clemens Creek is typically mid to late October.

Port Renfrew (Area 20): The San Juan fence has been installed. Swim surveys of the San Juan and major tributaries will be conducted following fence removal to produce a Coho peak count.

Nitinat (Area 22): Four swims are planned in Nitinat starting in mid-September. Hatchery staff observed thousands of fish in the river, and a swim survey this week counted roughly 6,000 adult Chinook and 1,200 jack Chinook.

Barkley Sound/Alberni Inlet (Area 23): Initial surveys have been completed on schedule in Area 23. Chinook are at least ~70% of the 12 year average in Nahmint, and are at least ~90% the 12 year average in Sarita. It is too early to determine the magnitude of the Clemens sockeye return based on the current surveys, but the Henderson River fence operated by Uchucklesaht and the NTC has estimated roughly 9400 Sockeye passing into Henderson Lake.

Clayoquot Sound (Area 24): The surveys for Moyeha, Tranquil, Bedwell, Cypre and Megin have been completed; Chinook are at roughly the 12 year average in Moyeha and Cypre, and are slightly above the 12 year average in Bedwell. Megin and Tranquil Chinook peak counts are about 30% of the 12 year average. It is still too early for Coho to have peaked, however the Coho in Bedwell are already slightly above the 12 year average.

Nootka Sound/Esperanza Inlet (Area 25): Surveys of Tahsis, Leiner, Burman and Conuma have occurred generally as scheduled. Chinook are above the 12 year average in Burman, Leiner and Canton; peaked at 80% of the 12 year average in Conuma; and are slightly below 60% of the 12 year average in Tahsis. Sockeye numbers are also above the 12 year average in both the Tahsis and the Leiner. It is still too early for Coho to have peaked, however the Coho in Leiner are already roughly 150% of the 12 year average, other systems in the area are currently at about 30% of the 12 year average.

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[7] Precipitation totals from the Environment Canada Monitoring Station in Tofino

Kyuquot Sound (Area 26): Surveys of Kaouk, Artlish, and Tahsish have occurred roughly as scheduled, however data from this week's Kaouk swim is not yet available. Chinook are already slightly above the 12 year average in Tahsish, 40% of the 12 year average in Artlish, and almost 70% of the 12 year average in Kaouk.

Quatsino Sound (Area 27): Surveys of Marble and Cayeghle have occurred generally as scheduled. Chinook in both Marble and Cayeghle are at roughly 40% of the 12 year average.

ESCAPEMENT MONITORING FRAMEWORK:

For WCVI salmon and most other BC management units, a system of 'intensive' and 'extensive' indicator stocks are used to assess stock status and fishery impacts and provide recommendations for harvest management.

Intensive indicator stocks describe the distribution, exploitation and survival rate patterns for populations within a management unit that have a similar life history and marine distribution. This information is collected through the coast-wide Mark-Recovery Program (MRP). Select stocks are tagged with coded-wire-tags as juveniles and through recoveries of these tags in fisheries and escapement survival and exploitation rates are estimated.

Robertson Creek Hatchery located in DFO Statistical Area 23 (Barkley Sound/Alberni Inlet) is the CWT hatchery indicator stock for WCVI chinook and coho populations. Carnation Creek, also located in Area 23, is the CWT wild indicator stock for WCVI coho. There is no CWT indicator program from chum salmon.

Extensive indicator stocks provide information about the variability of status of populations across the management unit. The specific goals of the program are utilize consistent escapement survey methodologies; estimate total escapement by river using analytical techniques such as the area-under-the-curve (AUC) method for observation expansion; to establish a time series of escapement information and habitat capacity for use in establishing escapement goals; and to estimate hatchery contribution to rivers.

The following populations are used as extensive indicator stocks for WCVI salmon:

Chinook: Nitinat, Nahmint, Sarita, Bedwell/Ursus, Megin, Tranquil, Burman, Conuma, Leiner, Tahsis, Artlish, Kaouk, Tahsish, Colonial/Cayeghle, Marble

Coho: Malksope

Chum: Most of the Chinook indicators with the addition of Little Zeballos, Zeballos, and Park.

Other Escapement Information: Escapement information for non-indicator stocks may be provided through other programs. Depending on the frequency of surveys and types of methods employed, the resulting information may be of limited utility to inform management decisions. However, the observations provide a useful gauge of spawner distribution in rivers across the WCVI area and this information is used to monitor biodiversity.

Data Quality: The WCVI escapement monitoring program results in escapement estimates of variable quality. While all the information is useful, not all estimates should be accorded the same weight in fisheries management decisions.[8] The following guidelines were used to rank the escapement information presented in this bulletin:

Level 1 (High Quality) Estimates. Level 1 escapement estimates are subject to quality control and peer review. Estimates of abundance are reliable and include an estimate of uncertainty. For most years in the WCVI area, Level 1 estimates are limited to those generated through he "intensive" indicator stocks programs.

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This bulletin updates in-season assessment results of Level 1 to 3 escapement surveys for WCVI chinook, coho and chum populations. Note: during the survey escapement information may also be collected for other species.

IN-SEASON RESULTS:

Table 1 displays the raw peak spawner counts to date of WCVI salmon survey populations.

Table 2 displays the 5 and 12 year average estimated escapement for WCVI extensive indicator systems.

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WCVI Salmon Extensive Assessment Program Biologist
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[8] The ranking scheme here weighs heavily on the Research and Science Information Standard for New Zealand Fisheries (NZ Ministry of Fisheries, 2011). When ranking the quality of scientific information, information is evaluated according to how well it meets the following scientific principles: methodology has been subject to peer review, data are relevant to management decision, integrity, objectivity, and reliability (i.e. repeatability) of estimate.

Table 1. _Raw Peak Live plus Dead counts to date for 2016 WCVI salmon survey populations.

Fisheries and Oceans Canada | Pêches et Océans Canada

Total no. surveys: 66

Stock Assessment Division, South Coast Salmon
For more information contact: Diana McHugh
(250) 756-7006

2016 Preliminary Escapement Obervations

Summary Note:
Raw Peak Live Plus Dead Counts (I.e. maximum number of fish counted for any one survey). Sproat numbers current as of Sept 25, Stamp numbers as of Sept 25, Carnation as of Sept 29, San Juan as of Sept 28.

Level 1 Streams

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
23	CARNATION CREEK	Fence	-	-	-	-	-	-	CO
23	SPROAT RIVER	Fence	1	2,887	219,108	11	23	-	CN/SK
23	STAMP RIVER	Fence	14,630	19,629	220,176	4	592	3	CN/SK

Level 2 WCVI Indicator Streams

2016 Peak Live + Dead Count to Date

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
22	NITINAT RIVER	1	6,002	10	387	4	14	-	CN
23	CLEMENS CREEK	5	24	899	1,636	28	2	-	SK
23	NAHMINT RIVER	5	243	226	796	593	8	1	CN
23	SARITA RIVER	4	1,268	494	67	330	1	-	CN
24	BEDWELL RIVER	2	280	1,447	222	111	-	1	CN
24	MEGIN RIVER	2	14	215	1	341	1	-	CN
24	TRANQUIL CREEK	2	110	148	209	907	3	1	CN
25	BURMAN RIVER	3	3,227	449	566	1,027	-	-	CN
25	CONUMA RIVER	3	17,189	624	51	872	6	-	CN
25	LEINER RIVER	3	1,300	1,369	2,258	1,180	8	1	CN
25	LITTLE ZEBALLOS RIVER	0	-	-	-	-	-	-	CM
25	PARK RIVER	0	-	-	-	-	-	-	CM
25	TAHSIS RIVER	3	187	380	436	249	6	3	CN
25	ZEBALLOS RIVER	2	229	20	150	40	-	-	CM
26	ARTLISH RIVER	3	114	226	9	428	4	1	CN
26	KAOUK RIVER	3	215	1,230	41	173	7	1	CN
26	TAHSISH RIVER	2	331	875	21	720	3	3	CN
26	MALKSOPE RIVER	1	5	564	9	154	-	2	CO
27	CAYEGHLE SYSTEM	3	186	381	1	595	8	1	CN
27	MARBLE RIVER	3	1,122	349	-	3	24	-	CN

Level 3 Streams

2016 Peak Live + Dead Count to Date

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
20	SAN JUAN RIVER	Fence	1,149	1,075	6	2	7	1	CN
23	TOQUAHT RIVER	1	150	266	14	111	7	-	CN
24	CYPRE RIVER	2	961	428	18	16	-	1	CN
24	KENNEDY RIVER (UPPER)	2	1	-	2,016	-	-	-	SK/CO
24	MOYEHA RIVER	2	125	1,232	222	921	3	1	CN
25	CANTON CREEK	2	8,303	209	2	168	3	-	CN
25	CHUM CREEK	1	2	-	-	-	-	4	CM
25	ESPINOSA CREEK	2	-	-	-	-	-	-	CM
25	KLEEPTEE CREEK	2	2	1	-	350	-	-	CM
25	MOOYAH RIVER	1	-	-	-	-	-	-	CM
26	JANSEN CREEK	1	-	12	-	-	-	-	SK/CO

Table 2. Average escapement (last 5 and 12 years) for Level 2 WCVI Indicator Systems; for Chum Indicator Systems, only chum averages are presented as chum-directed surveys cover chinook and coho distributions and timing poorly.

		Average Escapement Estimates					
Area	**System**	**CN Adults**		**CO Adults**		**CM Adults**	
		5yr avg	**12yr avg**	**5yr avg**	**12yr avg**	**5yr avg**	**12yr avg**
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23	CLEMENS CREEK	200	100	2,200	2,100	120	130
23	NAHMINT RIVER	300	300	500	400	12,300	14,900
23	SARITA RIVER	1,400	1,400	900	700	11,600	9,900
24	BEDWELL RIVER	380	200	1,300	1,200	3,300	3,300
24	MEGIN RIVER	60	50	1,600	1,100	1,900	1,900
24	TRANQUIL CREEK	320	390	1,000	800	9,000	9,400
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27	MARBLE RIVER	3,200	3,100	1,400	2,000	NA	NA

WCVI ESCAPEMENT BULLETIN – SEPTEMBER 30, 2016

Fisheries and Oceans Canada | Pêches et Océans Canada

WCVI Salmon Escapement Bulletin
Chinook, Coho and Chum
Extensive Indicator Program
In-season Update, September 30, 2016

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River levels were fairly low through most of the summer, but a rain event in late-August, over 140mm of rain from Aug 27 to Sept 4, caused high water levels in many index systems, bringing Chinook and Coho into many systems and briefly delaying the first swims in some index systems.[9] Chinook spawning has begun in most systems.

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Nootka Sound/Esperanza Inlet (Area 25): Surveys of Tahsis, Leiner, Burman and Conuma have occurred generally as scheduled. Chinook are above the 12 year average in Burman, Leiner and Canton; peaked at 80% of the 12 year average in Conuma; and are slightly below 60% of the 12 year average in Tahsis. Sockeye numbers are also above the 12 year average in both the Tahsis and the Leiner. It is still too early for Coho to have peaked, however the Coho in Leiner are already roughly 150% of the 12 year average, other systems in the area are currently at about 30% of the 12 year average.

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[10] The ranking scheme here weighs heavily on the Research and Science Information Standard for New Zealand Fisheries (NZ Ministry of Fisheries, 2011). When ranking the quality of scientific information, information is evaluated according to how well it meets the following scientific principles: methodology has been subject to peer review, data are relevant to management decision, integrity, objectivity, and reliability (i.e. repeatability) of estimate.

Table 1. _Raw Peak Live plus Dead counts to date for 2016 WCVI salmon survey populations.

Fisheries and Oceans Canada Pêches et Océans Canada

Total no. surveys: 66

Stock Assessment Division, South Coast Salmon
For more information contact: Diana McHugh
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2016 Preliminary Escapement Obervations

Summary Note:
Raw Peak Live Plus Dead Counts (I.e. maximum number of fish counted for any one survey). Sproat numbers current as of Sept 25, Stamp numbers as of Sept 25, Carnation as of Sept 29, San Juan as of Sept 28.

Level 1 Streams

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
23	CARNATION CREEK	Fence	-	-	-	-	-	-	CO
23	SPROAT RIVER	Fence	1	2,887	219,108	11	23	-	CN/SK
23	STAMP RIVER	Fence	14,630	19,629	220,176	4	592	3	CN/SK

Level 2 WCVI Indicator Streams **2016 Peak Live + Dead Count to Date**

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
22	NITINAT RIVER	1	6,002	10	387	4	14	-	CN
23	CLEMENS CREEK	5	24	899	1,636	28	2	-	SK
23	NAHMINT RIVER	5	243	226	796	593	8	1	CN
23	SARITA RIVER	4	1,268	494	67	330	1	-	CN
24	BEDWELL RIVER	2	280	1,447	222	111	-	1	CN
24	MEGIN RIVER	2	14	215	1	341	1	-	CN
24	TRANQUIL CREEK	2	110	148	209	907	3	1	CN
25	BURMAN RIVER	3	3,227	449	566	1,027	-	-	CN
25	CONUMA RIVER	3	17,189	624	51	872	6	-	CN
25	LEINER RIVER	3	1,300	1,369	2,258	1,180	8	1	CN
25	LITTLE ZEBALLOS RIVER	0	-	-	-	-	-	-	CM
25	PARK RIVER	0	-	-	-	-	-	-	CM
25	TAHSIS RIVER	3	187	380	436	249	6	3	CN
25	ZEBALLOS RIVER	2	229	20	150	40	-	-	CM
26	ARTLISH RIVER	3	114	226	9	428	4	1	CN
26	KAOUK RIVER	3	215	1,230	41	173	7	1	CN
26	TAHSISH RIVER	2	331	875	21	720	3	3	CN
26	MALKSOPE RIVER	1	5	564	9	154	-	2	CO
27	CAYEGHLE SYSTEM	3	186	381	1	595	8	1	CN
27	MARBLE RIVER	3	1,122	349	-	3	24	-	CN

Level 3 Streams **2016 Peak Live + Dead Count to Date**

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
20	SAN JUAN RIVER	Fence	1,149	1,075	6	2	7	1	CN
23	TOQUAHT RIVER	1	150	266	14	111	7	-	CN
24	CYPRE RIVER	2	961	428	18	16	-	1	CN
24	KENNEDY RIVER (UPPER)	2	1	-	2,016	-	-	-	SK/CO
24	MOYEHA RIVER	2	125	1,232	222	921	3	1	CN
25	CANTON CREEK	2	8,303	209	2	168	3	-	CN
25	CHUM CREEK	1	2	-	-	-	-	4	CM
25	ESPINOSA CREEK	2	-	-	-	-	-	-	CM
25	KLEEPTEE CREEK	2	2	1	-	350	-	-	CM
25	MOOYAH RIVER	1	-	-	-	-	-	-	CM
26	JANSEN CREEK	1	-	12	-	-	-	-	SK/CO

Table 2. Average escapement (last 5 and 12 years) for Level 2 WCVI Indicator Systems; for Chum Indicator Systems, only chum averages are presented as chum-directed surveys cover chinook and coho distributions and timing poorly.

		Average Escapement Estimates					
Area	**System**	**CN Adults**		**CO Adults**		**CM Adults**	
		5yr avg	**12yr avg**	**5yr avg**	**12yr avg**	**5yr avg**	**12yr avg**
20	SAN JUAN RIVER	1,600	1,900	7,300	5,600	1,200	900
22	NITINAT RIVER	10,900	10,300	4,700	4,700	158,000	144,000
23	CLEMENS CREEK	200	100	2,200	2,100	120	130
23	NAHMINT RIVER	300	300	500	400	12,300	14,900
23	SARITA RIVER	1,400	1,400	900	700	11,600	9,900
24	BEDWELL RIVER	380	200	1,300	1,200	3,300	3,300
24	MEGIN RIVER	60	50	1,600	1,100	1,900	1,900
24	TRANQUIL CREEK	320	390	1,000	800	9,000	9,400
25	BURMAN RIVER	4,000	2,400	1,300	1,300	5,200	4,800
25	CONUMA RIVER	28,000	21,700	2,200	2,500	7,900	9,000
25	LEINER RIVER	480	420	1,040	850	2,500	4,200
25	LITTLE ZEBALLOS RIVER	NA	NA	NA	NA	4,500	3,900
25	PARK RIVER	NA	NA	NA	NA	3,300	4,500
25	TAHSIS RIVER	270	330	1,300	1,400	5,400	6,400
25	TSOWWIN RIVER	NA	NA	NA	NA	1,600	4,700
25	ZEBALLOS RIVER	NA	NA	NA	NA	5,400	5,800
26	ARTLISH RIVER	370	280	1,900	1,400	5,700	4,700
26	KAOUK RIVER	260	320	2,600	2,300	9,900	8,800
26	MALKSOPE	NA	NA	2,300	2,300	10,400	10,400
26	TAHSISH RIVER	430	330	3,400	2,700	6,500	5,500
27	CAYEGHLE SYSTEM	310	430	800	840	12,600	10,700
27	MARBLE RIVER	3,200	3,100	1,400	2,000	NA	NA

WCVI ESCAPEMENT BULLETIN – OCTOBER 7, 2016

Fisheries and Oceans Canada Pêches et Océans Canada

WCVI Salmon Escapement Bulletin
Chinook, Coho and Chum
Extensive Indicator Program
In-season Update, October 7, 2016

IN-SEASON OBSERVATIONS:

River levels were fairly low through most of the summer, but a rain event in late-August, over 140mm of rain from Aug 27 to Sept 4, caused high water levels in many index systems, bringing Chinook and Coho into many systems and briefly delaying the first swims in some index systems.[1] Chinook spawning is widespread in most systems. Chum are also beginning to spawn.

Peak escapement of Chinook to WCVI rivers is typically about the first week of October.

Peak escapement of Chum to WCVI rivers is typically mid to late October.

Peak escapement of Coho to WCVI rivers is typically late October to early November.

Peak escapement of Sockeye to Clemens Creek is typically mid to late October.

Port Renfrew (Area 20): The San Juan fence has been removed as of Oct 3. Swim surveys of the San Juan and major tributaries will be conducted to produce a Coho peak count.

Nitinat (Area 22): Four swims are planned in Nitinat starting in mid-September. A swim survey this week counted roughly 3,400 Chum in the river and hatchery staff reported several large schools holding in the Lake.

Barkley Sound/Alberni Inlet (Area 23): Surveys have been completed generally on schedule in Area 23, though this week's Sarita swim was cancelled due to high water. Chinook are at least ~70% of the 12 year average in Nahmint, and are at least ~90% the 12 year average in Sarita. It is too early to determine the magnitude of the Clemens sockeye return based on the current surveys, but the Henderson River fence operated by Uchucklesaht and the NTC has estimated roughly 9400 Sockeye passing into Henderson Lake.

Clayoquot Sound (Area 24): The surveys for Moyeha, Tranquil, Bedwell, Cypre and Megin have been completed; Chinook are at roughly the 12 year average in Moyeha and Cypre, and are slightly above the 12 year average in Bedwell. Megin and Tranquil Chinook peak counts are about 30% of the 12 year average. It is still too early for Coho to have peaked, however the Coho in Bedwell are already slightly above the 12 year average.

Nootka Sound/Esperanza Inlet (Area 25): Surveys of Tahsis, Leiner, Burman and Conuma have occurred generally as scheduled, however this week's Tahsis, Leiner and Conuma surveys were not completed due to high water. Chinook are above the 12 year average in Burman, Leiner, Canton, Zeballos, and Little Zeballos; peaked at 80% of the 12 year average in Conuma; and are slightly below 60% of the 12 year average in Tahsis. Sockeye numbers are also above the 12 year average in Tahsis, Leiner and Burman. It is still too early for Coho to have peaked, however the Coho in Leiner are already roughly 150% of the 12 year average, other systems in the area are currently at about 30% of the 12 year average.

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[1] Precipitation totals from the Environment Canada Monitoring Station in Tofino

Kyuquot Sound (Area 26): Surveys of Kaouk, Artlish, and Tahsish have occurred roughly as scheduled, however data from this week are not yet available. Chinook are already slightly above the 12 year average in Tahsish, 40% of the 12 year average in Artlish, and almost 70% of the 12 year average in Kaouk.

Quatsino Sound (Area 27): Surveys of Marble and Cayeghle have occurred generally as scheduled. Chinook in both Marble and Cayeghle are at roughly 40% of the 12 year average. Coho in Cayeghle are at roughly 70% of the 12 year average.

ESCAPEMENT MONITORING FRAMEWORK:

For WCVI salmon and most other BC management units, a system of 'intensive' and 'extensive' indicator stocks are used to assess stock status and fishery impacts and provide recommendations for harvest management.

Intensive indicator stocks describe the distribution, exploitation and survival rate patterns for populations within a management unit that have a similar life history and marine distribution. This information is collected through the coast-wide Mark-Recovery Program (MRP). Select stocks are tagged with coded-wire-tags as juveniles and through recoveries of these tags in fisheries and escapement survival and exploitation rates are estimated.

Robertson Creek Hatchery located in DFO Statistical Area 23 (Barkley Sound/Alberni Inlet) is the CWT hatchery indicator stock for WCVI chinook and coho populations. Carnation Creek, also located in Area 23, is the CWT wild indicator stock for WCVI coho. There is no CWT indicator program from chum salmon.

Extensive indicator stocks provide information about the variability of status of populations across the management unit. The specific goals of the program are utilize consistent escapement survey methodologies; estimate total escapement by river using analytical techniques such as the area-under-the-curve (AUC) method for observation expansion; to establish a time series of escapement information and habitat capacity for use in establishing escapement goals; and to estimate hatchery contribution to rivers.

The following populations are used as extensive indicator stocks for WCVI salmon:

Chinook: Nitinat, Nahmint, Sarita, Bedwell/Ursus, Megin, Tranquil, Burman, Conuma, Leiner, Tahsis, Artlish, Kaouk, Tahsish, Colonial/Cayeghle, Marble

Coho: Malksope

Chum: Most of the Chinook indicators with the addition of Little Zeballos, Zeballos, and Park.

Other Escapement Information: Escapement information for non-indicator stocks may be provided through other programs. Depending on the frequency of surveys and types of methods employed, the resulting information may be of limited utility to inform management decisions. However, the observations provide a useful gauge of spawner distribution in rivers across the WCVI area and this information is used to monitor biodiversity.

Data Quality: The WCVI escapement monitoring program results in escapement estimates of variable quality. While all the information is useful, not all estimates should be accorded the

same weight in fisheries management decisions.[2] The following guidelines were used to rank the escapement information presented in this bulletin:

Level 1 (High Quality) Estimates. Level 1 escapement estimates are subject to quality control and peer review. Estimates of abundance are reliable and include an estimate of uncertainty. For most years in the WCVI area, Level 1 estimates are limited to those generated through he "intensive" indicator stocks programs.

Level 2 (Medium or Mixed Quality) Estimates. These estimates have some inherent shortcomings with regard to scientific quality (e.g. greater uncertainly, potential biases, etc.); however they are still useful for informing fishery management decisions. For WCVI spawning populations, Level 2 escapement estimates have typically been generated through periodic visual counts of spawners using the snorkel survey method and expanding for observer error and survey life with the area-under-the-curve procedure.

Level 3 (Low Quality) Estimates. These estimates substantially fail to meet standards of scientific quality and therefore are of limited utility for informing fishery management decisions. However, the information is still used to monitor biodiversity within the WCVI management area. Level 3 escapement information may include observations gathered from partial or infrequent surveys or using methods subject to higher observation error (e.g. bank walks).

This bulletin updates in-season assessment results of Level 1 to 3 escapement surveys for WCVI chinook, coho and chum populations. Note: during the survey escapement information may also be collected for other species.

IN-SEASON RESULTS:

Table 1 displays the raw peak spawner counts to date of WCVI salmon survey populations.

Table 2 displays the 5 and 12 year average estimated escapement for WCVI extensive indicator systems.

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[2] The ranking scheme here weighs heavily on the Research and Science Information Standard for New Zealand Fisheries (NZ Ministry of Fisheries, 2011). When ranking the quality of scientific information, information is evaluated according to how well it meets the following scientific principles: methodology has been subject to peer review, data are relevant to management decision, integrity, objectivity, and reliability (i.e. repeatability) of estimate.

Table 1. Raw Peak Live plus Dead counts to date for 2016 WCVI salmon survey populations.

Stock Assessment Division, South Coast Salmon

For more information contact:
WCVI: Diana McHugh (250) 756-7006

Total no. surveys: 90

2016 Preliminary Escapement Obervations

Summary Note:
Raw Peak Live Plus Dead Counts (i.e. maximum number of fish counted for any one survey). Sproat numbers current as of Oct 5, Stamp numbers as of Oct 5, Carnation as of Sept 29, San Juan as of Oct 3 when the fence was removed.

Level 1 Streams

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
23	CARNATION CREEK	Fence	-	-	-	-	-	-	CO
23	SPROAT RIVER	Fence	3	4,198	219,134	11	25	-	CN/SK
23	STAMP RIVER	Fence	23,238	22,141	220,190	4	616	8	CN/SK

Level 2 WCVI Indicator Streams **2016 Peak Live + Dead Count to Date**

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
22	NITINAT RIVER	2	6,002	2,026	387	3,430	26	-	CN
23	CLEMENS CREEK	6	24	984	2,525	45	3	-	SK
23	NAHMINT RIVER	6	243	260	882	1,570	8	1	CN
23	SARITA RIVER	4	1,268	494	67	330	1	-	CN
24	BEDWELL RIVER	2	280	1,447	222	111	-	1	CN
24	MEGIN RIVER	2	14	215	1	341	1	-	CN
24	TRANQUIL CREEK	3	157	382	214	1,352	3	2	CN
25	BURMAN RIVER	6	5,468	416	1,253	2,000	-	-	CN
25	CONUMA RIVER	4	17,189	624	51	872	6	2	CN
25	LEINER RIVER	4	1,300	1,369	2,258	1,180	8	1	CN
25	LITTLE ZEBALLOS RIVER	1	215	25	107	887	7	-	CM
25	PARK RIVER	0	-	-	-	-	-	-	CM
25	TAHSIS RIVER	4	187	380	436	264	6	3	CN
25	ZEBALLOS RIVER	3	253	20	640	4,021	-	-	CM
26	ARTLISH RIVER	3	114	226	9	428	4	1	CN
26	KAOUK RIVER	4	215	1,283	41	412	7	1	CN
26	TAHSISH RIVER	2	331	875	21	720	3	3	CN
26	MALKSOPE RIVER	2	5	809	9	634	-	2	CO
27	CAYEGHLE SYSTEM	4	186	615	3	595	8	1	CN
27	MARBLE RIVER	4	1,122	349	-	3	24	-	CN

Level 3 Streams **2016 Peak Live + Dead Count to Date**

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
20	SAN JUAN RIVER	Fence	1,218	1,136	6	4	7	1	CN
23	COUS CREEK	1	-	-	-	-	-	-	
23	MACKTUSH CREEK	1	-	-	-	-	-	-	CM
23	SOMASS RIVER (Lower)	1	3,152	1,711	-	-	-	-	CM
23	TOQUAHT RIVER	2	150	266	27	978	7	-	CN
24	CYPRE RIVER	2	961	428	18	16	-	1	CN
24	KENNEDY RIVER (UPPER)	2	1	-	2,016	-	-	-	SK/CO
24	MOYEHA RIVER	2	125	1,232	221	930	3	1	CN
25	CANTON CREEK	3	8,303	293	6	357	3	-	CN
25	CHUM CREEK	1	2	-	-	-	-	4	CM
25	ESPINOSA CREEK	2	-	-	-	6	-	-	CM
25	KLEEPTEE CREEK	3	21	11	8	399	-	-	CM
25	MOOYAH RIVER	1	-	-	-	-	-	-	CM
26	JANSEN CREEK	1	-	12	-	-	-	-	SK/CO
26	KASHUTL RIVER	1	-	97	1	136	-	-	CM
26	KAUWINCH RIVER	1	22	216	37	376	-	2	CM

Table 2. Average escapement (last 5 and 12 years) for Level 2 WCVI Indicator Systems; for Chum Indicator Systems, only chum averages are presented as chum-directed surveys cover chinook and coho distributions and timing poorly.

Area	System	Average Escapement Estimates					
		CN Adults		CO Adults		CM Adults	
		5yr avg	12yr avg	5yr avg	12yr avg	5yr avg	12yr avg
20	SAN JUAN RIVER	1,600	1,900	7,300	5,600	1,200	900
22	NITINAT RIVER	10,900	10,300	4,700	4,700	158,000	144,000
23	CLEMENS CREEK	200	100	2,200	2,100	120	130
23	NAHMINT RIVER	300	300	500	400	12,300	14,900
23	SARITA RIVER	1,400	1,400	900	700	11,600	9,900
24	BEDWELL RIVER	380	200	1,300	1,200	3,300	3,300
24	MEGIN RIVER	60	50	1,600	1,100	1,900	1,900
24	TRANQUIL CREEK	320	390	1,000	800	9,000	9,400
25	BURMAN RIVER	4,000	2,400	1,300	1,300	5,200	4,800
25	CONUMA RIVER	28,000	21,700	2,200	2,500	7,900	9,000
25	LEINER RIVER	480	420	1,040	850	2,500	4,200
25	LITTLE ZEBALLOS RIVER	NA	NA	NA	NA	4,500	3,900
25	PARK RIVER	NA	NA	NA	NA	3,300	4,500
25	TAHSIS RIVER	270	330	1,300	1,400	5,400	6,400
25	TSOWWIN RIVER	NA	NA	NA	NA	1,600	4,700
25	ZEBALLOS RIVER	NA	NA	NA	NA	5,400	5,800
26	ARTLISH RIVER	370	280	1,900	1,400	5,700	4,700
26	KAOUK RIVER	260	320	2,600	2,300	9,900	8,800
26	MALKSOPE	NA	NA	2,300	2,300	10,400	10,400
26	TAHSISH RIVER	430	330	3,400	2,700	6,500	5,500
27	CAYEGHLE SYSTEM	310	430	800	840	12,600	10,700
27	MARBLE RIVER	3,200	3,100	1,400	2,000	NA	NA

WCVI ESCAPEMENT BULLETIN – OCTOBER 14, 2016

Fisheries and Oceans Canada | Pêches et Océans Canada

WCVI Salmon Escapement Bulletin
Chinook, Coho and Chum
Extensive Indicator Program
In-season Update, October 14, 2016

IN-SEASON OBSERVATIONS:

A set of three major storms this week has delayed some surveys and may bring in the bulk of the Chum return. Nahmint has seen 140mm of rain between Oct 12 and today at noon with an additional storm due tomorrow. Chinook spawning has largely concluded in most systems, and Chum and Sockeye are beginning to spawn.

Due to heavy rains, the video equipment has been pulled from both Sproat and Stamp. The latest counts at Sproat were minimal, less than 200 Coho per day, however at Stamp we were counting between 500 and 1,000 Chinook per day.

Water levels will need to drop considerably before the video equipment can be reinstalled.

Peak escapement of Chinook to WCVI rivers is typically about the first week of October.

Peak escapement of Chum to WCVI rivers is typically mid to late October.

Peak escapement of Coho to WCVI rivers is typically late October to early November.

Peak escapement of Sockeye to Clemens Creek is typically mid to late October.

Port Renfrew (Area 20): The San Juan fence has been removed as of Oct 3. Swim surveys of the San Juan and major tributaries will be conducted to produce a Coho peak count.

Nitinat (Area 22): Four swims were planned in Nitinat starting in mid-September. A swim survey this week of the lower river counted roughly 48,000 Chum under less than ideal conditions. Spawning chum were observed filling the river from bank to bank in riffles in the lower river.

Barkley Sound/Alberni Inlet (Area 23): Surveys have been completed generally on schedule in Area 23. Chinook are above the 12 year average in Nahmint, and are at least ~90% the 12 year average in Sarita. Chum are at least ~90% the 12 year average in Nahmint, are at least 50% of the 12 year average in Sarita, and are above the 12 year average in Clemens. It is too early to determine the magnitude of the Clemens sockeye return based on the current surveys, but the Henderson River fence operated by Uchucklesaht and the NTC has estimated roughly 9400 Sockeye passing into Henderson Lake.

Clayoquot Sound (Area 24): The surveys for Moyeha, Cypre and Megin have been delayed by weather. Recent surveys are only available from Tranquil (Oct 3) and Bedwell (Oct 10); Chinook are at roughly the 12 year average in Moyeha and Cypre, and are above the 12 year average in Bedwell. Megin and Tranquil Chinook peak counts are about 30-40% of the 12 year average. Chum are roughly 30% of the 12 year average in Bedwell.

Nootka Sound/Esperanza Inlet (Area 25): Surveys of Tahsis, Leiner, Burman and Conuma have occurred generally as scheduled, though this week's Burman survey is not currently available. Chinook are above the 12 year average in Burman, Leiner, Canton, Zeballos, and Little Zeballos; peaked at 80% of the 12 year average in Conuma; and are slightly below 60% of the 12 year average in Tahsis. Chum are above the 12 year average in Leiner; are at roughly 80% of the 12 year average in Canton, Conuma, and Zeballos; and are 40-50% of the 12 year average in Tahsis.

Kyuquot Sound (Area 26): Surveys of Kaouk, Artlish, and Tahsish have occurred roughly as scheduled, though Artlish, and Tahsish surveys from this week are not available. Chinook are slightly above the 12 year average in Tahsish, 40% of the 12 year average in Artlish, and almost 70% of the 12 year average in Kaouk. Chum are at roughly 15% of the 12 year average in Kaouk, Tahsish, Malksope, and Kauwinch; and 10% of the 12 year average in Artlish.

Quatsino Sound (Area 27): Surveys of Marble and Cayeghle have occurred generally as scheduled. Chinook in both Marble and Cayeghle are at roughly 40% of the 12 year average. Coho in Cayeghle are at roughly 90% of the 12 year average. Chum in Cayeghle area at 10-15% of the 12 year average.

ESCAPEMENT MONITORING FRAMEWORK:

For WCVI salmon and most other BC management units, a system of 'intensive' and 'extensive' indicator stocks are used to assess stock status and fishery impacts and provide recommendations for harvest management.

Intensive indicator stocks describe the distribution, exploitation and survival rate patterns for populations within a management unit that have a similar life history and marine distribution. This information is collected through the coast-wide Mark-Recovery Program (MRP). Select stocks are tagged with coded-wire-tags as juveniles and through recoveries of these tags in fisheries and escapement survival and exploitation rates are estimated.

Robertson Creek Hatchery located in DFO Statistical Area 23 (Barkley Sound/Alberni Inlet) is the CWT hatchery indicator stock for WCVI chinook and coho populations. Carnation Creek, also located in Area 23, is the CWT wild indicator stock for WCVI coho. There is no CWT indicator program from chum salmon.

Extensive indicator stocks provide information about the variability of status of populations across the management unit. The specific goals of the program are utilize consistent escapement survey methodologies; estimate total escapement by river using analytical techniques such as the area-under-the-curve (AUC) method for observation expansion; to establish a time series of escapement information and habitat capacity for use in establishing escapement goals; and to estimate hatchery contribution to rivers.

The following populations are used as extensive indicator stocks for WCVI salmon:

Chinook: Nitinat, Nahmint, Sarita, Bedwell/Ursus, Megin, Tranquil, Burman, Conuma, Leiner, Tahsis, Artlish, Kaouk, Tahsish, Colonial/Cayeghle, Marble

Coho: Malksope

Chum: Most of the Chinook indicators with the addition of Little Zeballos, Zeballos, and Park.

Other Escapement Information: Escapement information for non-indicator stocks may be provided through other programs. Depending on the frequency of surveys and types of methods employed, the resulting information may be of limited utility to inform management decisions. However, the observations provide a useful gauge of spawner distribution in rivers across the WCVI area and this information is used to monitor biodiversity.

Data Quality: The WCVI escapement monitoring program results in escapement estimates of variable quality. While all the information is useful, not all estimates should be accorded the same weight in fisheries management decisions.[1] The following guidelines were used to rank the escapement information presented in this bulletin:

Level 1 (High Quality) Estimates. Level 1 escapement estimates are subject to quality control and peer review. Estimates of abundance are reliable and include an estimate of uncertainty. For most years in the WCVI area, Level 1 estimates are limited to those generated through he "intensive" indicator stocks programs.

Level 2 (Medium or Mixed Quality) Estimates. These estimates have some inherent shortcomings with regard to scientific quality (e.g. greater uncertainly, potential biases, etc.); however they are still useful for informing fishery management decisions. For WCVI spawning populations, Level 2 escapement estimates have typically been generated through periodic visual counts of spawners using the snorkel survey method and expanding for observer error and survey life with the area-under-the-curve procedure.

Level 3 (Low Quality) Estimates. These estimates substantially fail to meet standards of scientific quality and therefore are of limited utility for informing fishery management decisions. However, the information is still used to monitor biodiversity within the WCVI management area. Level 3 escapement information may include observations gathered from partial or infrequent surveys or using methods subject to higher observation error (e.g. bank walks).

This bulletin updates in-season assessment results of Level 1 to 3 escapement surveys for WCVI chinook, coho and chum populations. Note: during the survey escapement information may also be collected for other species.

IN-SEASON RESULTS:

Table 1 displays the raw peak spawner counts to date of WCVI salmon survey populations.

Table 2 displays the 5 and 12 year average estimated escapement for WCVI extensive indicator systems.

For more information Contact:
Diana McHugh,
WCVI Salmon Extensive Assessment Program Biologist
Telephone (250) 756-7006, Fax (250) 756-7162
E-mail: Diana.McHugh@dfo-mpo.gc.ca

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[1] The ranking scheme here weighs heavily on the Research and Science Information Standard for New Zealand Fisheries (NZ Ministry of Fisheries, 2011). When ranking the quality of scientific information, information is evaluated according to how well it meets the following scientific principles: methodology has been subject to peer review, data are relevant to management decision, integrity, objectivity, and reliability (i.e. repeatability) of estimate.

Table 1. Raw Peak Live plus Dead counts to date for 2016 WCVI salmon survey populations.

Stock Assessment Division, South Coast Salmon

For more information contact:

Total no. surveys: 108

WCVI: Diana McHugh (250) 756-7006

2016 Preliminary Escapement Obervations

Summary Note:
Raw Peak Live Plus Dead Counts (i.e. maximum number of fish counted for any one survey). Sproat numbers current as of Oct 10, Stamp numbers as of Oct 10, Carnation as of Oct 13, San Juan as of Oct 3 when the fence was removed.

Level 1 Streams

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
23	CARNATION CREEK	Fence	-	61	-	5	-	-	CO
23	SPROAT RIVER	Fence	80	6,789	219,250	11	29	-	CN/SK
23	STAMP RIVER	Fence	35,014	23,014	220,203	8	622	8	CN/SK

Level 2 WCVI Indicator Streams **2016 Peak Live + Dead Count to Date**

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
22	NITINAT RIVER	3	6,002	2,026	387	47,676	26	1	CN
23	CLEMENS CREEK	7	35	1,123	5,169	145	3	-	SK
23	NAHMINT RIVER	7	495	260	940	13,320	8	1	CN
23	SARITA RIVER	5	1,296	494	67	5,070	1	-	CN
24	BEDWELL RIVER	3	382	1,447	222	1,051	-	1	CN
24	MEGIN RIVER	2	14	215	1	341	1	-	CN
24	TRANQUIL CREEK	3	157	382	214	1,352	3	2	CN
25	BURMAN RIVER	6	5,468	416	1,253	2,000	-	-	CN
25	CONUMA RIVER	5	17,189	946	51	7,761	6	2	CN
25	LEINER RIVER	5	1,300	1,369	2,258	5,056	8	1	CN
25	LITTLE ZEBALLOS RIVER	1	215	25	107	887	7	-	CM
25	PARK RIVER	0	-	-	-	-	-	-	CM
25	TAHSIS RIVER	5	187	481	436	3,041	7	3	CN
25	ZEBALLOS RIVER	3	253	20	640	5,000	-	-	CM
26	ARTLISH RIVER	4	114	226	9	428	4	1	CN
26	KAOUK RIVER	6	215	1,573	41	1,342	7	1	CN
26	TAHSISH RIVER	3	331	875	21	779	4	3	CN
26	MALKSOPE RIVER	3	5	907	14	1,398	-	2	CO
27	CAYEGHLE SYSTEM	5	186	735	3	1,433	8	1	CN
27	MARBLE RIVER	4	1,122	349	-	3	24	-	CN

Level 3 Streams **2016 Peak Live + Dead Count to Date**

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
20	SAN JUAN RIVER	Fence	1,218	1,136	6	4	7	1	CN
23	COUS CREEK	1	-	-	-	-	-	-	
23	MACKTUSH CREEK	1	-	-	-	-	-	-	CM
23	SOMASS RIVER (Lower)	1	3,152	1,711	-	-	-	-	CM
23	TOQUAHT RIVER	2	150	266	27	978	7	-	CN
24	CYPRE RIVER	2	961	428	18	16	-	1	CN
24	KENNEDY RIVER (UPPER)	2	1	-	2,016	-	-	-	SK/CO
24	MOYEHA RIVER	2	125	1,232	221	930	3	1	CN
25	CANTON CREEK	4	8,303	516	13	2,004	3	-	CN
25	CHUM CREEK	1	2	-	-	-	-	4	CM
25	ESPINOSA CREEK	2	-	-	-	6	-	-	CM
25	KLEEPTEE CREEK	3	21	11	8	399	-	-	CM
25	MOOYAH RIVER	1	-	-	-	-	-	-	CM
25	OKTWANCH RIVER	1	6	-	106	-	-	-	SK
26	JANSEN CREEK	1	-	12	-	-	-	-	SK/CO
26	KASHUTL RIVER	1	-	97	1	136	-	-	CM
26	KAUWINCH RIVER	1	22	216	37	376	-	2	CM

Table 2. Average escapement (last 5 and 12 years) for Level 2 WCVI Indicator Systems; for Chum Indicator Systems, only chum averages are presented as chum-directed surveys cover chinook and coho distributions and timing poorly.

Area	System	Average Escapement Estimates					
		CN Adults		CO Adults		CM Adults	
		5yr avg	12yr avg	5yr avg	12yr avg	5yr avg	12yr avg
20	SAN JUAN RIVER	1,600	1,900	7,300	5,600	1,200	900
22	NITINAT RIVER	10,900	10,300	4,700	4,700	158,000	144,000
23	CLEMENS CREEK	200	100	2,200	2,100	120	130
23	NAHMINT RIVER	300	300	500	400	12,300	14,900
23	SARITA RIVER	1,400	1,400	900	700	11,600	9,900
24	BEDWELL RIVER	380	200	1,300	1,200	3,300	3,300
24	MEGIN RIVER	60	50	1,600	1,100	1,900	1,900
24	TRANQUIL CREEK	320	390	1,000	800	9,000	9,400
25	BURMAN RIVER	4,000	2,400	1,300	1,300	5,200	4,800
25	CONUMA RIVER	28,000	21,700	2,200	2,500	7,900	9,000
25	LEINER RIVER	480	420	1,040	850	2,500	4,200
25	LITTLE ZEBALLOS RIVER	NA	NA	NA	NA	4,500	3,900
25	PARK RIVER	NA	NA	NA	NA	3,300	4,500
25	TAHSIS RIVER	270	330	1,300	1,400	5,400	6,400
25	TSOWWIN RIVER	NA	NA	NA	NA	1,600	4,700
25	ZEBALLOS RIVER	NA	NA	NA	NA	5,400	5,800
26	ARTLISH RIVER	370	280	1,900	1,400	5,700	4,700
26	KAOUK RIVER	260	320	2,600	2,300	9,900	8,800
26	MALKSOPE	NA	NA	2,300	2,300	10,400	10,400
26	TAHSISH RIVER	430	330	3,400	2,700	6,500	5,500
27	CAYEGHLE SYSTEM	310	430	800	840	12,600	10,700
27	MARBLE RIVER	3,200	3,100	1,400	2,000	NA	NA

WCVI ESCAPEMENT BULLETIN – OCTOBER 21, 2016

Fisheries and Oceans Canada
Pêches et Océans Canada

WCVI Salmon Escapement Bulletin
Chinook, Coho and Chum
Extensive Indicator Program
In-season Update, October 21, 2016

IN-SEASON OBSERVATIONS:

A series of major rain events this week have delayed many surveys and may have brought in the bulk of the Chum return. Nahmint has seen over 250mm of rain between Oct 14 and today at 9am with an additional storm due early next week. Chum and Sockeye are now spawning.

Peak escapement of Chinook to WCVI rivers is typically about the first week of October.

Peak escapement of Chum to WCVI rivers is typically mid to late October.

Peak escapement of Coho to WCVI rivers is typically late October to early November.

Peak escapement of Sockeye to Clemens Creek is typically mid to late October.

Port Renfrew (Area 20): The San Juan fence has been removed as of Oct 3. Swim surveys of the San Juan and major tributaries will be conducted to produce a Coho peak count.

Nitinat (Area 22): Four swims were planned in Nitinat starting in mid-September. A swim survey last week of the lower river counted roughly 48,000 Chum under less than ideal conditions. Spawning chum were observed filling the river from bank to bank in riffles in the lower river.

Barkley Sound/Alberni Inlet (Area 23): Clemens Creek was the only system surveyed this week due to high water levels. Chum in Nahmint and Sarita will likely peak this week or next, so current peak counts are probably low. Chinook are above the 12 year average in Nahmint, and are at least ~90% the 12 year average in Sarita. Chum are at least ~90% the 12 year average in Nahmint, are at least 50% of the 12 year average in Sarita, and are above the 12 year average in Clemens. The Clemens sockeye return is much improved from last year with spawning observed throughout the survey area and along the beach in front of the hatchery. The peak count is roughly two thirds of the 12 year average peak count. The Henderson River fence operated by Uchucklesaht and the NTC has estimated roughly 9400 Sockeye passing into Henderson Lake.

Clayoquot Sound (Area 24): The surveys Clayoquot have been delayed by weather; no surveys from this week are available. Fairly recent surveys are only available from Tranquil (Oct 3) and Bedwell (Oct 10); Chinook are at roughly the 12 year average in Moyeha and Cypre, and are above the 12 year average in Bedwell. Megin and Tranquil Chinook peak counts are about 30-40% of the 12 year average. As of Oct 10, Chum were roughly 30% of the 12 year average in Bedwell, but they will likely peak next week based on historical timing.

Nootka Sound/Esperanza Inlet (Area 25): Surveys of Tahsis, Leiner, Burman and Conuma were cancelled this week due to high water levels. The only new information this week is a bank walk of Zeballos which counted a significant number of Chum, more than two and a half times the 12 year average. Chinook are above the 12 year average in Burman, Leiner, Canton, Zeballos, and Little Zeballos; peaked at 80% of the 12 year average in Conuma; and are slightly below 60% of the 12 year average in Tahsis. Chum are above the 12 year average in Leiner; are at roughly 80% of the 12 year average in Canton, and Conuma; and are 40-50% of the 12 year average in Tahsis.

Kyuquot Sound (Area 26): Surveys of Kaouk, Malksope and Tahsish were cancelled due to high water levels, but Artlish was surveyed this week. Chinook are slightly above the 12 year average in Tahsish, 40% of the 12 year average in Artlish, and almost 70% of the 12 year average in Kaouk. Chum are at roughly 15% of the 12 year average in Kaouk, Tahsish, Malksope, and Kauwinch; and about 60% of the 12 year average in Artlish. Coho are at least 90% of the 12 year average in Artlish, and were roughly 70% of the 12 year average in Kaouk as of last week.

Quatsino Sound (Area 27): Due to high water levels, Marble was last surveyed Oct 4 and Cayeghle was last surveyed Oct 11. Chinook in both Marble and Cayeghle are at roughly 40% of the 12 year average. Coho in Cayeghle are at roughly 90% of the 12 year average. Chum in Cayeghle area at 10-15% of the 12 year average.

ESCAPEMENT MONITORING FRAMEWORK:

For WCVI salmon and most other BC management units, a system of 'intensive' and 'extensive' indicator stocks are used to assess stock status and fishery impacts and provide recommendations for harvest management.

Intensive indicator stocks describe the distribution, exploitation and survival rate patterns for populations within a management unit that have a similar life history and marine distribution. This information is collected through the coast-wide Mark-Recovery Program (MRP). Select stocks are tagged with coded-wire-tags as juveniles and through recoveries of these tags in fisheries and escapement survival and exploitation rates are estimated.

Robertson Creek Hatchery located in DFO Statistical Area 23 (Barkley Sound/Alberni Inlet) is the CWT hatchery indicator stock for WCVI chinook and coho populations. Carnation Creek, also located in Area 23, is the CWT wild indicator stock for WCVI coho. There is no CWT indicator program from chum salmon.

Extensive indicator stocks provide information about the variability of status of populations across the management unit. The specific goals of the program are utilize consistent escapement survey methodologies; estimate total escapement by river using analytical techniques such as the area-under-the-curve (AUC) method for observation expansion; to establish a time series of escapement information and habitat capacity for use in establishing escapement goals; and to estimate hatchery contribution to rivers.

The following populations are used as extensive indicator stocks for WCVI salmon:

Chinook: Nitinat, Nahmint, Sarita, Bedwell/Ursus, Megin, Tranquil, Burman, Conuma, Leiner, Tahsis, Artlish, Kaouk, Tahsish, Colonial/Cayeghle, Marble

Coho: Malksope

Chum: Most of the Chinook indicators with the addition of Little Zeballos, Zeballos, and Park.

Other Escapement Information: Escapement information for non-indicator stocks may be provided through other programs. Depending on the frequency of surveys and types of methods employed, the resulting information may be of limited utility to inform management

Table 1. Raw Peak Live plus Dead counts to date for 2016 WCVI salmon survey populations.

Stock Assessment Division, South Coast Salmon

For more information contact:

Total no. surveys: 109

WCVI: Diana McHugh (250) 756-7006

2016 Preliminary Escapement Obervations

Summary Note:
Raw Peak Live Plus Dead Counts (i.e. maximum number of fish counted for any one survey). Sproat numbers current as of Oct 12, Stamp numbers as of Oct 12, Carnation as of Oct 20, San Juan as of Oct 3 when the fence was removed.

Level 1 Streams

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
23	CARNATION CREEK	Fence	-	104	-	19	-	-	CO
23	SPROAT RIVER	Fence	199	6,822	219,298	11	29	-	CN/SK
23	STAMP RIVER	Fence	37,841	23,236	220,203	12	627	7	CN/SK

Level 2 WCVI Indicator Streams **2016 Peak Live + Dead Count to Date**

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
22	NITINAT RIVER	3	6,002	2,026	387	48,666	26	1	CN
23	CLEMENS CREEK	8	35	1,183	5,169	171	3	-	SK
23	NAHMINT RIVER	7	495	260	940	13,280	8	1	CN
23	SARITA RIVER	5	1,298	500	67	5,069	1	-	CN
24	BEDWELL RIVER	3	382	1,449	222	1,051	-	1	CN
24	MEGIN RIVER	2	14	215	1	345	1	-	CN
24	TRANQUIL CREEK	3	157	382	220	1,366	3	2	CN
25	BURMAN RIVER	6	5,468	416	1,253	2,000	-	-	CN
25	CONUMA RIVER	5	17,189	946	51	7,761	6	2	CN
25	LEINER RIVER	5	1,300	1,369	2,258	5,056	8	1	CN
25	LITTLE ZEBALLOS RIVER	1	215	25	107	887	7	-	CM
25	PARK RIVER	0	-	-	-	-	-	-	CM
25	TAHSIS RIVER	5	187	481	436	3,041	7	3	CN
25	ZEBALLOS RIVER	4	253	33	640	16,297	-	-	CM
26	ARTLISH RIVER	5	114	1,258	9	2,905	4	1	CN
26	KAOUK RIVER	6	215	1,573	41	1,342	7	1	CN
26	TAHSISH RIVER	3	331	875	21	779	4	3	CN
26	MALKSOPE RIVER	3	5	907	14	1,398	-	2	CO
27	CAYEGHLE SYSTEM	5	186	735	3	1,433	8	1	CN
27	MARBLE RIVER	4	1,122	349	-	3	24	-	CN

Level 3 Streams **2016 Peak Live + Dead Count to Date**

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
20	SAN JUAN RIVER	Fence	1,218	1,136	6	4	7	1	CN
23	COUS CREEK	1	-	-	-	-	-	-	
23	MACKTUSH CREEK	1	-	-	-	-	-	-	CM
23	SOMASS RIVER (Lower)	1	3,152	1,711	-	-	-	-	CM
23	TOQUAHT RIVER	2	153	266	28	982	7	-	CN
24	CYPRE RIVER	2	961	428	18	16	-	1	CN
24	KENNEDY RIVER (UPPER)	2	1	-	2,493	-	-	-	SK/CO
24	MOYEHA RIVER	2	125	1,232	221	930	3	1	CN
25	CANTON CREEK	4	8,303	516	13	2,004	3	-	CN
25	CHUM CREEK	1	2	-	-	-	-	4	CM
25	ESPINOSA CREEK	2	-	-	-	6	-	-	CM
25	KLEEPTEE CREEK	3	21	11	8	399	-	-	CM
25	MOOYAH RIVER	1	-	-	-	-	-	-	CM
25	OKTWANCH RIVER	1	6	-	106	-	-	-	SK
26	JANSEN CREEK	1	-	12	-	-	-	-	SK/CO
26	KASHUTL RIVER	1	-	97	1	136	-	-	CM
26	KAUWINCH RIVER	1	22	216	37	376	-	2	CM

Table 2. Average escapement (last 5 and 12 years) for Level 2 WCVI Indicator Systems; for Chum Indicator Systems, only chum averages are presented as chum-directed surveys cover chinook and coho distributions and timing poorly.

Area	System	Average Escapement Estimates					
		CN Adults		CO Adults		CM Adults	
		5yr avg	12yr avg	5yr avg	12yr avg	5yr avg	12yr avg
20	SAN JUAN RIVER	1,600	1,900	7,300	5,600	1,200	900
22	NITINAT RIVER	10,900	10,300	4,700	4,700	158,000	144,000
23	CLEMENS CREEK	200	100	2,200	2,100	120	130
23	NAHMINT RIVER	300	300	500	400	12,300	14,900
23	SARITA RIVER	1,400	1,400	900	700	11,600	9,900
24	BEDWELL RIVER	380	200	1,300	1,200	3,300	3,300
24	MEGIN RIVER	60	50	1,600	1,100	1,900	1,900
24	TRANQUIL CREEK	320	390	1,000	800	9,000	9,400
25	BURMAN RIVER	4,000	2,400	1,300	1,300	5,200	4,800
25	CONUMA RIVER	28,000	21,700	2,200	2,600	7,900	9,000
25	LEINER RIVER	480	420	1,040	850	2,500	4,200
25	LITTLE ZEBALLOS RIVER	NA	NA	NA	NA	4,500	3,900
25	PARK RIVER	NA	NA	NA	NA	3,300	4,500
25	TAHSIS RIVER	270	330	1,300	1,400	5,400	6,400
25	TSOWWIN RIVER	NA	NA	NA	NA	1,600	4,700
25	ZEBALLOS RIVER	NA	NA	NA	NA	5,400	5,800
26	ARTLISH RIVER	370	280	1,900	1,400	5,700	4,700
26	KAOUK RIVER	260	320	2,600	2,300	9,900	8,800
26	MALKSOPE	NA	NA	2,300	2,300	10,400	10,400
26	TAHSISH RIVER	430	330	3,400	2,700	6,500	5,500
27	CAYEGHLE SYSTEM	310	430	800	840	12,600	10,700
27	MARBLE RIVER	3,200	3,100	1,400	2,000	NA	NA

WCVI ESCAPEMENT BULLETIN – OCTOBER 28, 2016

Fisheries and Oceans Canada
Pêches et Océans Canada

WCVI Salmon Escapement Bulletin
Chinook, Coho and Chum
Extensive Indicator Program
In-season Update, October 28, 2016

IN-SEASON OBSERVATIONS:

Another series of rain events this week kept water levels elevated and delayed many surveys. Nahmint has seen over 220mm of rain between Oct 21 and today at 10am, but rain is expected to ease for the next few days with the next storm not due until next Tuesday. Some surveys may be completed over the next few days. Chum and Sockeye are now spawning, and a few Coho have started spawning.

Peak escapement of Chinook to WCVI rivers is typically about the first week of October.

Peak escapement of Chum to WCVI rivers is typically mid to late October.

Peak escapement of Coho to WCVI rivers is typically late October to early November.

Peak escapement of Sockeye to Clemens Creek is typically mid to late October.

Port Renfrew (Area 20): The San Juan fence has been removed as of Oct 3. Swim surveys of the San Juan and major tributaries will be conducted to produce a Coho peak count. San Juan was surveyed this week, but the tributary surveys were delayed by high water

Nitinat (Area 22): Four swims were planned in Nitinat starting in mid-September. A swim survey two weeks ago of the lower river counted roughly 48,000 Chum under less than ideal conditions. Spawning chum were observed filling the river from bank to bank in riffles in the lower river.

Barkley Sound/Alberni Inlet (Area 23): Clemens Creek was one of the only two systems surveyed this week due to high water levels. Chum in Nahmint and Sarita will likely peak this week or next, so current peak counts are probably low. Chinook are above the 12 year average in Nahmint, and are at least ~90% the 12 year average in Sarita. Chum are at least ~90% the 12 year average in Nahmint, are at least 50% of the 12 year average in Sarita, and are above the 12 year average in Clemens. The Clemens sockeye return is much improved from last year with spawning observed throughout the survey area and along the beach in front of the hatchery. The peak count is roughly two thirds of the 12 year average peak count. The Henderson River fence operated by Uchucklesaht and the NTC has estimated roughly 9400 Sockeye passing into Henderson Lake.

Clayoquot Sound (Area 24): The surveys Clayoquot have been delayed by weather; no surveys from this week are available. Fairly recent surveys are only available from Tranquil (Oct 3) and Bedwell (Oct 10); Chinook are at roughly the 12 year average in Moyeha and Cypre, and are above the 12 year average in Bedwell. Megin and Tranquil Chinook peak counts are about 30-40% of the 12 year average. As of Oct 10, Chum were roughly 30% of the 12 year average in Bedwell, but they likely peaked this week based on historical timing.

Nootka Sound/Esperanza Inlet (Area 25): Surveys of Tahsis, Leiner, Burman and Conuma were cancelled again this week due to high water levels. Chinook are above the 12 year average in Burman, Leiner, Canton, Zeballos, and Little Zeballos; peaked at 80% of the 12 year average in Conuma; and are slightly below 60% of the 12 year average in Tahsis. As of Oct 12th, Chum were above the 12 year average in Leiner; at roughly 80% of the 12 year average in Canton, and Conuma; and 40-50% of the 12 year average in Tahsis.

Kyuquot Sound (Area 26): Surveys of Kaouk, Artlish, Malksope and Tahsish were cancelled due to high water levels. Chinook are slightly above the 12 year average in Tahsish, 40% of the 12 year average in Artlish, and almost 70% of the 12 year average in Kaouk. Chum are at roughly 15% of the 12 year average in Kaouk, Tahsish, Malksope, and Kauwinch; and about 60% of the 12 year average in Artlish. Coho are at least 90% of the 12 year average in Artlish, and were roughly 70% of the 12 year average in Kaouk as of two weeks ago.

Quatsino Sound (Area 27): Due to high water levels, Marble was last surveyed Oct 4 and Cayeghle was last surveyed Oct 11. Chinook in both Marble and Cayeghle are at roughly 40% of the 12 year average. Coho in Cayeghle are at roughly 90% of the 12 year average. Chum in Cayeghle area at 10-15% of the 12 year average.

ESCAPEMENT MONITORING FRAMEWORK:

For WCVI salmon and most other BC management units, a system of 'intensive' and 'extensive' indicator stocks are used to assess stock status and fishery impacts and provide recommendations for harvest management.

Intensive indicator stocks describe the distribution, exploitation and survival rate patterns for populations within a management unit that have a similar life history and marine distribution. This information is collected through the coast-wide Mark-Recovery Program (MRP). Select stocks are tagged with coded-wire-tags as juveniles and through recoveries of these tags in fisheries and escapement survival and exploitation rates are estimated.

Robertson Creek Hatchery located in DFO Statistical Area 23 (Barkley Sound/Alberni Inlet) is the CWT hatchery indicator stock for WCVI chinook and coho populations. Carnation Creek, also located in Area 23, is the CWT wild indicator stock for WCVI coho. There is no CWT indicator program from chum salmon.

Extensive indicator stocks provide information about the variability of status of populations across the management unit. The specific goals of the program are utilize consistent escapement survey methodologies; estimate total escapement by river using analytical techniques such as the area-under-the-curve (AUC) method for observation expansion; to establish a time series of escapement information and habitat capacity for use in establishing escapement goals; and to estimate hatchery contribution to rivers.

The following populations are used as extensive indicator stocks for WCVI salmon:

Chinook: Nitinat, Nahmint, Sarita, Bedwell/Ursus, Megin, Tranquil, Burman, Conuma, Leiner, Tahsis, Artlish, Kaouk, Tahsish, Colonial/Cayeghle, Marble

Coho: Malksope

Chum: Most of the Chinook indicators with the addition of Little Zeballos, Zeballos, and Park.

Other Escapement Information: Escapement information for non-indicator stocks may be provided through other programs. Depending on the frequency of surveys and types of methods employed, the resulting information may be of limited utility to inform management decisions. However, the observations provide a useful gauge of spawner distribution in rivers across the WCVI area and this information is used to monitor biodiversity.

Data Quality: The WCVI escapement monitoring program results in escapement estimates of variable quality. While all the information is useful, not all estimates should be accorded the same weight in fisheries management decisions.[1] The following guidelines were used to rank the escapement information presented in this bulletin:

Level 1 (High Quality) Estimates. Level 1 escapement estimates are subject to quality control and peer review. Estimates of abundance are reliable and include an estimate of uncertainty. For most years in the WCVI area, Level 1 estimates are limited to those generated through he "intensive" indicator stocks programs.

Level 2 (Medium or Mixed Quality) Estimates. These estimates have some inherent shortcomings with regard to scientific quality (e.g. greater uncertainly, potential biases, etc.); however they are still useful for informing fishery management decisions. For WCVI spawning populations, Level 2 escapement estimates have typically been generated through periodic visual counts of spawners using the snorkel survey method and expanding for observer error and survey life with the area-under-the-curve procedure.

Level 3 (Low Quality) Estimates. These estimates substantially fail to meet standards of scientific quality and therefore are of limited utility for informing fishery management decisions. However, the information is still used to monitor biodiversity within the WCVI management area. Level 3 escapement information may include observations gathered from partial or infrequent surveys or using methods subject to higher observation error (e.g. bank walks).

This bulletin updates in-season assessment results of Level 1 to 3 escapement surveys for WCVI chinook, coho and chum populations. Note: during the survey escapement information may also be collected for other species.

IN-SEASON RESULTS:

Table 1 displays the raw peak spawner counts to date of WCVI salmon survey populations.

Table 2 displays the 5 and 12 year average estimated escapement for WCVI extensive indicator systems.

For more information Contact:
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[1] The ranking scheme here weighs heavily on the Research and Science Information Standard for New Zealand Fisheries (NZ Ministry of Fisheries, 2011). When ranking the quality of scientific information, information is evaluated according to how well it meets the following scientific principles: methodology has been subject to peer review, data are relevant to management decision, integrity, objectivity, and reliability (i.e. repeatability) of estimate.

Table 1. Raw Peak Live plus Dead counts to date for 2016 WCVI salmon survey populations.

Stock Assessment Division, South Coast Salmon

For more information contact:
WCVI: Diana McHugh (250) 756-7006

Total no. surveys: 111

2016 Preliminary Escapement Obervations

Summary Note:
Raw Peak Live Plus Dead Counts (I.e. maximum number of fish counted for any one survey). Sproat numbers current as of Oct 13 when the cameras were pulled, Stamp numbers as of Oct 23, San Juan as of Oct 3 when the fence was removed, and Carnation as of Oct 27. Carnation total does not include 132 Coho jacks which have also gone through the fence.

Level 1 Streams

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
23	CARNATION CREEK	Fence	-	187	-	110	-	-	CO
23	SPROAT RIVER	Fence	199	6,822	219,298	9	27	-	CN/SK
23	STAMP RIVER	Fence	45,774	23,585	220,203	12	636	8	CN/SK

Level 2 WCVI Indicator Streams **2016 Peak Live + Dead Count to Date**

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
22	NITINAT RIVER	3	6,002	2,026	387	48,666	26	1	CN
23	CLEMENS CREEK	9	35	1,343	5,169	171	3	-	SK
23	NAHMINT RIVER	7	495	260	940	13,280	8	1	CN
23	SARITA RIVER	5	1,298	500	67	5,069	1	-	CN
24	BEDWELL RIVER	3	382	1,449	222	1,051	-	1	CN
24	MEGIN RIVER	2	14	215	1	345	1	-	CN
24	TRANQUIL CREEK	3	157	382	220	1,366	3	2	CN
25	BURMAN RIVER	6	5,468	416	1,253	2,000	-	-	CN
25	CONUMA RIVER	5	17,189	946	51	7,761	6	2	CN
25	LEINER RIVER	5	1,300	1,369	2,258	5,056	8	1	CN
25	LITTLE ZEBALLOS RIVER	1	215	25	107	887	7	-	CM
25	PARK RIVER	0	-	-	-	-	-	-	CM
25	TAHSIS RIVER	5	187	481	436	3,041	7	3	CN
25	ZEBALLOS RIVER	4	253	33	640	16,297	-	-	CM
26	ARTLISH RIVER	5	121	1,258	9	2,905	4	1	CN
26	KAOUK RIVER	6	215	1,570	41	1,342	7	1	CN
26	TAHSISH RIVER	3	331	875	21	779	4	3	CN
26	MALKSOPE RIVER	3	5	907	10	1,400	-	2	CO
27	CAYEGHLE SYSTEM	5	186	735	3	1,433	8	1	CN
27	MARBLE RIVER	4	1,122	349	-	3	24	-	CN

Level 3 Streams 2016 Peak Live + Dead Count to Date

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
20	SAN JUAN RIVER	1	1,218	1,136	6	534	7	1	CN
23	COUS CREEK	1	-	-	-	-	-	-	
23	MACKTUSH CREEK	1	-	-	-	-	-	-	CM
23	SOMASS RIVER (Lower)	1	3,152	1,711	-	-	-	-	CM
23	TOQUAHT RIVER	2	153	266	28	982	7	-	CN
24	CYPRE RIVER	2	961	428	18	16	-	1	CN
24	KENNEDY RIVER (UPPER)	2	1	-	2,493	-	-	-	SK/CO
24	MOYEHA RIVER	2	125	1,232	221	930	3	1	CN
25	CANTON CREEK	4	8,303	516	13	2,004	3	-	CN
25	CHUM CREEK	1	2	-	-	-	-	4	CM
25	ESPINOSA CREEK	2	-	-	-	6	-	-	CM
25	KLEEPTEE CREEK	3	21	11	8	399	-	-	CM
25	MOOYAH RIVER	1	-	-	-	-	-	-	CM
25	OKTWANCH RIVER	1	6	-	106	-	-	-	SK
26	JANSEN CREEK	1	-	12	-	-	-	-	SK/CO
26	KASHUTL RIVER	1	-	97	1	136	-	-	CM
26	KAUWINCH RIVER	1	15	216	37	376	-	2	CM

Table 2. Average escapement (last 5 and 12 years) for Level 2 WCVI Indicator Systems; for Chum Indicator Systems, only chum averages are presented as chum-directed surveys cover chinook and coho distributions and timing poorly.

Area	System	Average Escapement Estimates					
		CN Adults		CO Adults		CM Adults	
		5yr avg	12yr avg	5yr avg	12yr avg	5yr avg	12yr avg
20	SAN JUAN RIVER	1,600	1,900	7,300	5,600	1,200	900
22	NITINAT RIVER	10,900	10,300	4,700	4,700	158,000	144,000
23	CLEMENS CREEK	200	100	2,200	2,100	120	130
23	NAHMINT RIVER	300	300	500	400	12,300	14,900
23	SARITA RIVER	1,400	1,400	900	700	11,600	9,900
24	BEDWELL RIVER	380	200	1,300	1,200	3,300	3,300
24	MEGIN RIVER	60	50	1,600	1,100	1,900	1,900
24	TRANQUIL CREEK	320	390	1,000	800	9,000	9,400
25	BURMAN RIVER	4,000	2,400	1,300	1,300	5,200	4,800
25	CONUMA RIVER	28,000	21,700	2,200	2,500	7,900	9,000
25	LEINER RIVER	480	420	1,040	650	2,500	4,200
25	LITTLE ZEBALLOS RIVER	NA	NA	NA	NA	4,500	3,900
25	PARK RIVER	NA	NA	NA	NA	3,300	4,500
25	TAHSIS RIVER	270	330	1,300	1,400	5,400	6,400
25	TSOWWIN RIVER	NA	NA	NA	NA	1,600	4,700
25	ZEBALLOS RIVER	NA	NA	NA	NA	5,400	5,800
26	ARTLISH RIVER	370	280	1,900	1,400	5,700	4,700
26	KAOUK RIVER	260	320	2,600	2,300	9,900	8,800
26	MALKSOPE	NA	NA	2,300	2,300	10,400	10,400
26	TAHSISH RIVER	430	330	3,400	2,700	6,500	5,500
27	CAYEGHLE SYSTEM	310	430	800	840	12,600	10,700
27	MARBLE RIVER	3,200	3,100	1,400	2,000	NA	NA

Fisheries and Oceans Canada
Pêches et Océans Canada

WCVI Salmon Escapement Bulletin
Chinook, Coho and Chum
Extensive Indicator Program
In-season Update, November 4, 2016

IN-SEASON OBSERVATIONS:

Another series of rain events this week kept water levels elevated and delayed many surveys, but a brief window early in the week allowed some surveys to proceed. Chum and Sockeye are now spawning, and a few Coho have started spawning.

Peak escapement of Chinook to WCVI rivers is typically about the first week of October.

Peak escapement of Chum to WCVI rivers is typically mid to late October.

Peak escapement of Coho to WCVI rivers is typically late October to early November.

Peak escapement of Sockeye to Clemens Creek is typically mid to late October.

Port Renfrew (Area 20): The San Juan fence has been removed as of Oct 3. Swim surveys of the San Juan and major tributaries will be conducted to produce a Coho peak count. San Juan was surveyed last week, and one of the tributary surveys was completed this week. The remaining tributary surveys, Harris and Renfrew, were delayed by high water

Nitinat (Area 22): Four swims were planned in Nitinat starting in mid-September. A swim survey three weeks ago of the lower river counted roughly 48,000 Chum under less than ideal conditions. Spawning chum were observed filling the river from bank to bank in riffles in the lower river. A further survey of Nitinat may occur next week to assess the duration and extent of the chum spawn.

Barkley Sound/Alberni Inlet (Area 23): Nahmint, Sarita, and Clemens were all surveyed early this week. Chinook are above the 12 year average in Nahmint, and are at least ~90% the 12 year average in Sarita. Chum are at least ~90% the 12 year average in Nahmint and are above the 12 year average in Sarita and Clemens. The Clemens Sockeye return is much improved from last year with spawning observed throughout the survey area and along the beach in front of the hatchery. The peak count is roughly two thirds of the 12 year average peak count. The Henderson River fence operated by Uchucklesaht and the NTC has estimated roughly 9400 Sockeye passing into Henderson Lake. The Sockeye return to Nahmint is at least equal to the 12 year average. Coho are at least 60% of the 12 year average in Clemens and Nahmint, and at least 70% of the 12 year average in Sarita.

Clayoquot Sound (Area 24): The surveys Clayoquot have been delayed by weather, but Tranquil, Cypre and Bedwell were surveyed this week, and Warn Bay was surveyed twice in the last three weeks. Chinook are at roughly the 12 year average in Moyeha and Cypre, and are above the 12 year average in Bedwell. Megin and Tranquil Chinook peak counts are about 30-40% of the 12 year average. Chum are above the 12 year average in Bedwell and Cypre, roughly 75% of the 12 year average in Warn Bay, and may be as low as 15% of the 12 year average in Tranquil, though surveys likely missed the peak. Coho are above the 12 year average in Bedwell and similar to the 12 year average in Tranquil and Cypre.

Nootka Sound/Esperanza Inlet (Area 25): Surveys of Tahsis, Leiner, and Canton were completed this week, with the Conuma survey delayed by poor visibility. The most recent survey available from Burman was Oct 5. Chinook are above the 12 year average in Burman, Leiner, Canton, Zeballos, and Little Zeballos; peaked at 80% of the 12 year average in Conuma; and are slightly below 60% of the 12 year average in Tahsis. Chum are above the 12 year average in Leiner, Chum Creek, Park River, and Zeballos; at roughly 80% of the 12 year average in Canton, and Conuma; and 40-50% of the 12 year average in Burman and Tahsis. Coho are above the 12 year average in Leiner and Park, and 60-70% of the 12 year average in Tahsis and Canton.

Kyuquot Sound (Area 26): Surveys of Kaouk, Artlish, Tahsish, Malksope and Jansen were recently completed. Chinook are slightly above the 12 year average in Tahsish, 40% of the 12 year average in Artlish, and almost 70% of the 12 year average in Kaouk. Chum are at roughly 15% of the 12 year average in Malksope; 30-40% of the 12 year average in Tahsish and Kaouk; and well over the 12 year average in Artlish. Coho are at least 50% of the 12 year average in Artlish, and were roughly 75% of the 12 year average in Kaouk, and 30-40% of the 12 year average in Malksope and Tahsish.

Quatsino Sound (Area 27): Due to high water levels, Marble was last surveyed Oct 4 and Cayeghle was last surveyed Oct 11. Chinook in both Marble and Cayeghle are at roughly 40% of the 12 year average. Coho in Cayeghle are at roughly 90% of the 12 year average. Chum in Cayeghle area were at least 10-15% of the 12 year average.

ESCAPEMENT MONITORING FRAMEWORK:

For WCVI salmon and most other BC management units, a system of 'intensive' and 'extensive' indicator stocks are used to assess stock status and fishery impacts and provide recommendations for harvest management.

Intensive indicator stocks describe the distribution, exploitation and survival rate patterns for populations within a management unit that have a similar life history and marine distribution. This information is collected through the coast-wide Mark-Recovery Program (MRP). Select stocks are tagged with coded-wire-tags as juveniles and through recoveries of these tags in fisheries and escapement survival and exploitation rates are estimated.

Robertson Creek Hatchery located in DFO Statistical Area 23 (Barkley Sound/Alberni Inlet) is the CWT hatchery indicator stock for WCVI chinook and coho populations. Carnation Creek, also located in Area 23, is the CWT wild indicator stock for WCVI coho. There is no CWT indicator program from chum salmon.

Extensive indicator stocks provide information about the variability of status of populations across the management unit. The specific goals of the program are utilize consistent escapement survey methodologies; estimate total escapement by river using analytical techniques such as the area-under-the-curve (AUC) method for observation expansion; to establish a time series of escapement information and habitat capacity for use in establishing escapement goals; and to estimate hatchery contribution to rivers.

The following populations are used as extensive indicator stocks for WCVI salmon:

Chinook: Nitinat, Nahmint, Sarita, Bedwell/Ursus, Megin, Tranquil, Burman, Conuma, Leiner, Tahsis, Artlish, Kaouk, Tahsish, Colonial/Cayeghle, Marble

Coho: Malksope

Chum: Most of the Chinook indicators with the addition of Little Zeballos, Zeballos, and Park.

Other Escapement Information: Escapement information for non-indicator stocks may be provided through other programs. Depending on the frequency of surveys and types of methods employed, the resulting information may be of limited utility to inform management decisions. However, the observations provide a useful gauge of spawner distribution in rivers across the WCVI area and this information is used to monitor biodiversity.

Data Quality: The WCVI escapement monitoring program results in escapement estimates of variable quality. While all the information is useful, not all estimates should be accorded the same weight in fisheries management decisions.[1] The following guidelines were used to rank the escapement information presented in this bulletin:

Level 1 (High Quality) Estimates. Level 1 escapement estimates are subject to quality control and peer review. Estimates of abundance are reliable and include an estimate of uncertainty. For most years in the WCVI area, Level 1 estimates are limited to those generated through he "intensive" indicator stocks programs.

Level 2 (Medium or Mixed Quality) Estimates. These estimates have some inherent shortcomings with regard to scientific quality (e.g. greater uncertainly, potential biases, etc.); however they are still useful for informing fishery management decisions. For WCVI spawning populations, Level 2 escapement estimates have typically been generated through periodic visual counts of spawners using the snorkel survey method and expanding for observer error and survey life with the area-under-the-curve procedure.

Level 3 (Low Quality) Estimates. These estimates substantially fail to meet standards of scientific quality and therefore are of limited utility for informing fishery management decisions. However, the information is still used to monitor biodiversity within the WCVI management area. Level 3 escapement information may include observations gathered from partial or infrequent surveys or using methods subject to higher observation error (e.g. bank walks).

This bulletin updates in-season assessment results of Level 1 to 3 escapement surveys for WCVI chinook, coho and chum populations. Note: during the survey escapement information may also be collected for other species.

IN-SEASON RESULTS:

Table 1 displays the raw peak spawner counts to date of WCVI salmon survey populations.

Table 2 displays the 5 and 12 year average estimated escapement for WCVI extensive indicator systems.

For more information Contact:
Diana McHugh,
WCVI Salmon Extensive Assessment Program Biologist

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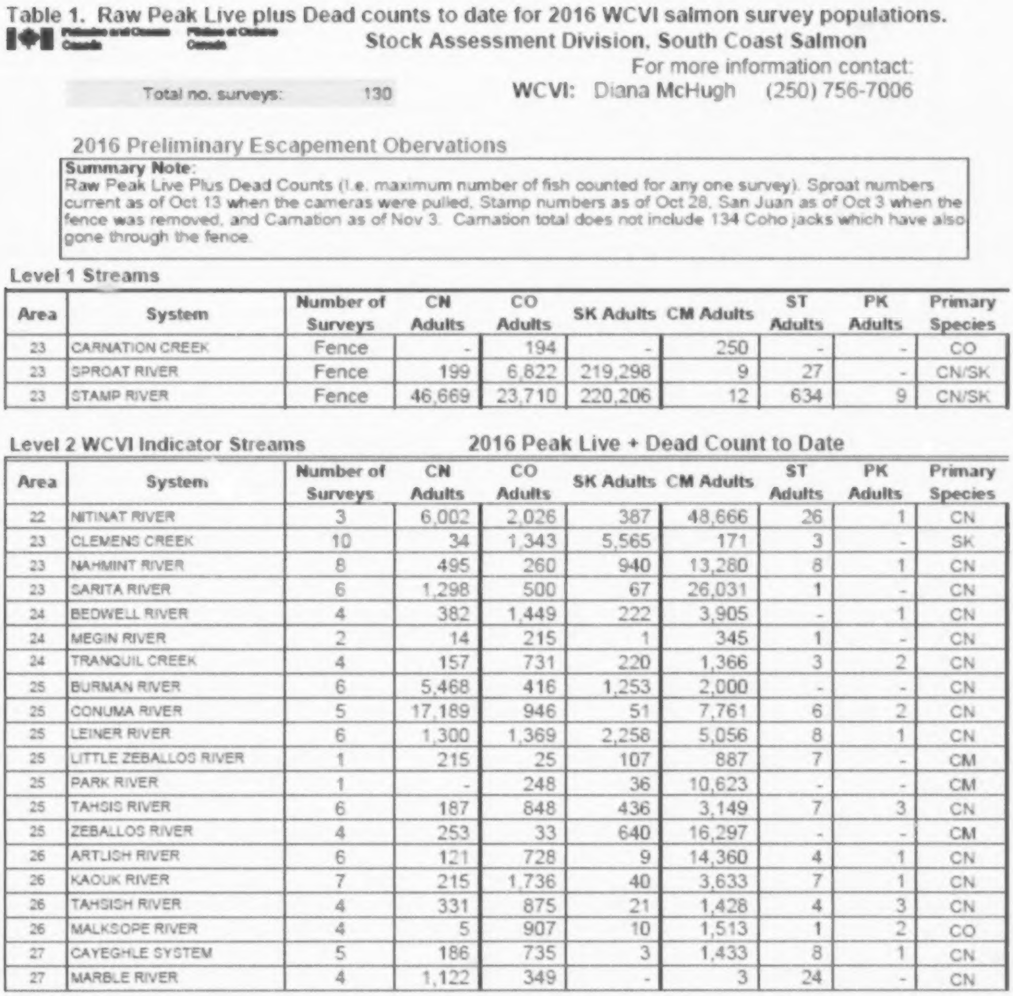

Table 1. Raw Peak Live plus Dead counts to date for 2016 WCVI salmon survey populations.

Stock Assessment Division, South Coast Salmon

For more information contact:

WCVI: Diana McHugh (250) 756-7006

Total no. surveys: 130

2016 Preliminary Escapement Obervations

Summary Note:
Raw Peak Live Plus Dead Counts (i.e. maximum number of fish counted for any one survey). Sproat numbers current as of Oct 13 when the cameras were pulled, Stamp numbers as of Oct 28, San Juan as of Oct 3 when the fence was removed, and Carnation as of Nov 3. Carnation total does not include 134 Coho jacks which have also gone through the fence.

Level 1 Streams

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
23	CARNATION CREEK	Fence	-	194	-	250	-	-	CO
23	SPROAT RIVER	Fence	199	6,822	219,298	9	27	-	CN/SK
23	STAMP RIVER	Fence	46,669	23,710	220,206	12	634	9	CN/SK

Level 2 WCVI Indicator Streams **2016 Peak Live + Dead Count to Date**

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
22	NITINAT RIVER	3	6,002	2,026	387	48,666	26	1	CN
23	CLEMENS CREEK	10	34	1,343	5,565	171	3	-	SK
23	NAHMINT RIVER	8	495	260	940	13,280	8	1	CN
23	SARITA RIVER	6	1,298	500	67	26,031	1	-	CN
24	BEDWELL RIVER	4	382	1,449	222	3,905	-	1	CN
24	MEGIN RIVER	2	14	215	1	345	1	-	CN
24	TRANQUIL CREEK	4	157	731	220	1,366	3	2	CN
25	BURMAN RIVER	6	5,468	416	1,253	2,000	-	-	CN
25	CONUMA RIVER	5	17,189	946	51	7,761	6	2	CN
25	LEINER RIVER	6	1,300	1,369	2,258	5,056	8	1	CN
25	LITTLE ZEBALLOS RIVER	1	215	25	107	887	7	-	CM
25	PARK RIVER	1	-	248	36	10,623	-	-	CM
25	TAHSIS RIVER	6	187	848	436	3,149	7	3	CN
25	ZEBALLOS RIVER	4	253	33	640	16,297	-	-	CM
26	ARTLISH RIVER	6	121	728	9	14,360	4	1	CN
26	KAOUK RIVER	7	215	1,736	40	3,633	7	1	CN
26	TAHSISH RIVER	4	331	875	21	1,428	4	3	CN
26	MALKSOPE RIVER	4	5	907	10	1,513	1	2	CO
27	CAYEGHLE SYSTEM	5	186	735	3	1,433	8	1	CN
27	MARBLE RIVER	4	1,122	349	-	3	24	-	CN

Level 3 Streams **2016 Peak Live + Dead Count to Date**

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
20	SAN JUAN RIVER	1	1,218	1,136	6	534	7	1	CN
20	LENS CREEK	1	3	619	2	7	-	-	CO
23	COUS CREEK	1	-	-	-	-	-	-	
23	MACKTUSH CREEK	1	-	-	-	-	-	-	CM
23	SOMASS RIVER (Lower)	1	3,152	1,711	-	-	-	-	CM
23	TOQUAHT RIVER	2	153	266	28	982	7	-	CN
24	CYPRE RIVER	3	961	1,230	18	3,337	-	1	CN
24	KENNEDY RIVER (UPPER)	2	1	-	2,493	-	-	-	SK/CO
24	MOYEHA RIVER	2	125	1,232	221	930	3	1	CN
24	WARN BAY CREEK	2	17	34	-	2,557	-	-	CM
25	CANTON CREEK	5	8,303	585	13	2,004	3	-	CN
25	CHUM CREEK	2	2	6	-	4,316	-	4	CM
25	ESPINOSA CREEK	2	-	-	-	6	-	-	CM
25	KLEEPTEE CREEK	3	21	11	8	399	-	-	CM
25	MOOYAH RIVER	1	-	-	-	-	-	-	CM
25	OKTWANCH RIVER	1	6	-	106	-	-	-	SK
26	JANSEN CREEK	2	-	12	-	-	-	-	SK/CO
26	KASHUTL RIVER	1	-	97	1	136	-	-	CM
26	KAUWINCH RIVER	1	15	216	37	376	-	2	CM

Table 2. Average escapement (last 5 and 12 years) for Level 2 WCVI Indicator Systems; for Chum Indicator Systems, only chum averages are presented as chum-directed surveys cover chinook and coho distributions and timing poorly.

Area	System	Average Escapement Estimates					
		CN Adults		CO Adults		CM Adults	
		5yr avg	12yr avg	5yr avg	12yr avg	5yr avg	12yr avg
20	SAN JUAN RIVER	1,600	1,900	7,300	5,600	1,200	900
22	NITINAT RIVER	10,900	10,300	4,700	4,700	158,000	144,000
23	CLEMENS CREEK	200	100	2,200	2,100	120	130
23	NAHMINT RIVER	300	300	500	400	12,300	14,900
23	SARITA RIVER	1,400	1,400	900	700	11,600	9,900
24	BEDWELL RIVER	380	200	1,300	1,200	3,300	3,300
24	MEGIN RIVER	60	50	1,600	1,100	1,900	1,900
24	TRANQUIL CREEK	320	390	1,000	800	9,000	9,400
25	BURMAN RIVER	4,000	2,400	1,300	1,300	5,200	4,800
25	CONUMA RIVER	28,000	21,700	2,200	2,500	7,900	9,000
25	LEINER RIVER	480	420	1,040	850	2,500	4,200
25	LITTLE ZEBALLOS RIVER	NA	NA	NA	NA	4,500	3,900
25	PARK RIVER	NA	NA	NA	NA	3,300	4,500
25	TAHSIS RIVER	270	330	1,300	1,400	5,400	6,400
25	TSOWWIN RIVER	NA	NA	NA	NA	1,600	4,700
25	ZEBALLOS RIVER	NA	NA	NA	NA	5,400	5,800
26	ARTLISH RIVER	370	280	1,900	1,400	5,700	4,700
26	KAOUK RIVER	260	320	2,600	2,300	9,900	8,800
26	MALKSOPE	NA	NA	2,300	2,300	10,400	10,400
26	TAHSISH RIVER	430	330	3,400	2,700	6,500	5,500
27	CAYEGHLE SYSTEM	310	430	800	840	12,600	10,700
27	MARBLE RIVER	3,200	3,100	1,400	2,000	NA	NA